Report of Santa Rosa County Stormwater Runoff Task Force

1. Introduction

The population in Santa Rosa County has doubled in ten years and continues to grow faster than either of our neighboring counties. Elected officials have become more aware of increasing problems with stormwater runoff. In 1995, Santa Rosa County instituted one of the more stringent stormwater management regulations in the State.

Stormwater runoff is comprised of the water that is in excess of that which can be absorbed by the surface on which rain falls. The water runs from such surfaces, picking up sediments, nutrients, pesticides, metals and other contaminants, and carried them into the streams, rivers, bayous and bays. As an area is developed, wetlands and vegetative surfaces are lost, as streets, highways, parking lots, roofs, sidewalks, driveways, and other impervious surfaces cover land that once was vegetated. On other surfaces disturbed but left bare without vegetation, such as dirt roads, the loose dirt is easily picked up and flushed across even the flat lands and out into the surface water. Northwest Florida's hilly topography and erosive soils and an average of 60 inches of rain per year — much of it in the form of torrential downpours — intensifies stormwater runoff impacts, and local flooding is common even after small rain events.

Wetland areas and vegetation strips, which serve as filtration systems can be overloaded with sedimentation from stormwater. Such natural filters also help maintain and improve the quality of degraded waters by removing nutrients, processing chemical and organic wastes, and reducing sediment deposition. However, everyday activities of all inhabitants of a watershed, such as car washing and lawn maintenance, contribute to the load of pollutants that stormwater deposits in surface waters. A public awareness of easy and inexpensive ways to manage polluting activities can diminish the severity of water quality degradation. With fewer wetlands and vegetated surfaces to "bank" the rainfall, contaminant and sediment-laden water is forced immediately into the rivers and streams — not over a period of time, as is normally done.

In January 2000, the Board of County Commissioners established a citizen Task Force on Stormwater Runoff to address this challenge. The objectives of this task force were:

1) **To thoroughly *review the impacts and consequences* of stormwater runoff on the water bodies in and around Santa Rosa County;**

2) **To *mitigate the negative impacts/consequences on both water quantity and quality* as identified;**

3) **To *make recommendations* to the Board of County Commissioners on actions it could undertake to reduce the negative impacts of stormwater runoff;**

4) **To make recommendations to the Board of County Commissioners on the development of *funding sources.***

The Task Force held public fact-finding and self-education meetings between January 2000 and January 2002, during which a series of guest experts, citizens, governmental officials, scientists, and environmental agency representatives presented information to focus the group on stormwater issues and solutions. **APPENDIX I** tabulates the names of the presenter and his/her professional affiliation and the subject of these presentations. The meetings were attended by the County Administrator, County Engineer, Director of Planning and Zoning, and other County officials, members of the press, and citizens who often provided input on issues of their specific concern.

1.1 Creation of Task Force and Appointment Process

The Santa Rosa County Task Force on Stormwater Runoff was an undertaking of the Santa Rosa County Commissioners. Each County Commissioner was allowed two appointees. The members selected were:

Task Force Member	Appointed by
Geoffrey Maddux, Chair	Debbie Dawsey, District 4
Vernon Compton	Byrd Mapoles, District 2
***Carla Cook**	Jim Williamson, District 1
+Mark Cotton	Jim Williamson, District 1
+Debbie Dawsey	Debbie Dawsey, District 4
Steve Duncan	Bill Lundin, District 3
+Frances Dunham	Bill Campbell, District 5
John Harper	Bill Lundin, District 3
***Kathie Martin**	Buck Lee, District 5
Alan M. Miller	Jim Williamson, District 1
***Wayne Newsome**	Buck Lee, District 5
Jack Sanborn	Byrd Maypoles, District 2
Dr. Enid Sisskin	Bill Campbell, District 5

*New members in year 2001;
+Replaced on Task Force, 2001.
See **APPENDIX II** for biographical information.

The County Administrator, Hunter Walker, County Engineer, Roger Blaylock, Director of Planning and Zoning, Kristen Andersen, and the Task Force technical advisor, Dr. Joe Eugene Lepo, also attended Task Force meetings.

Early on in the proceedings, the Task Force made certain broad decisions:

1) **Developing a *master plan* was to be the foundation of all other recommendations;**

2) **The master plan would include issues of *accountability, funding mechanisms, and mapping of problem areas;***

3) ***Quantity and quality issues of stormwater runoff* would be addressed;**

4) ***Community education* would be a priority.**

2. Master Plan

The Stormwater Master Plan will consist of a survey of current conditions, public education program, basin delineation, outfall locations, and planned improvements. The Master Plan will provide key elements and supporting documentation for the implementation and compliance with National Pollution Discharge Elimination System (NPDES) Phase II stormwater rules. The Water Quality Act of 1987 established the National Storm Water Program that provided a two-phase stormwater program incorporating a prioritized approach to stormwater. **APPENDIX III** provides additional detail concerning the NPDES stormwater rules.

Definition of terms used throughout this report are found in **APPENDIX IV** and supporting literature and reference materials are listed in **APPENDIX V**.

2.1. Identification of Areas with Stormwater Problems

Through a combination of review of county records, interviews with County staff, historical data, public workshops, questionnaires, and reports, including the 1980 Santa Rosa County Soil Survey and the Florida Natural Areas Inventory, the Stormwater Master Plan shall identify those areas currently flooding and/or likely to flood.

The Master Plan will use historical data, reports and current monitoring programs to determine areas where stormwater is degrading surface water quality. Once these data are assimilated, an evaluation should be made of those areas of critical concern by plotting the location of the identified flooding problems on maps with drainage basins maps.

The County shall prepare a countywide stormwater management plan that incorporates basin-specific master plans within which they will adopt levels of service for stormwater quantity and quality. In so doing they should identify clear and attainable objectives and define how progress toward them will be measured. Consideration may be given to submitting the Stormwater Management Plan, along with its measurable objectives and goals as a component of the County Comprehensive Plan.

Although the implementation of stormwater runoff control projects will be dependent on the capital expenditure required and the funding available, it is important to note that it will never cost less to fix current problems than now and the longer the delay, the more expensive the fix. The objectives should be tied to a time frame, for instance: 1) *Reduce the pollutant loading contribution from Santa Rosa County to Santa Rosa Sound to 50% of current levels by year 2020*; or 2) *eliminate residential flooding (water in the house) for the 100-year return interval storm event by year 2015*.

Water quality performance measurement may be an easily defined methodology. For example, if 60% of the stormwater outfalls currently directly discharging untreated stormwater into the sound are intercepted and treatment of the first inch of runoff is provided, then (based on the current state of the science), this should result in a 90 % pollution reduction to the Sound at each outfall, which would result in a presumption of 54% reduction in pollutant loading from Santa Rosa County to the Sound.

Ambient water quality improvements are not often practical objectives because there are other sources of pollution in adjoining counties and many other factors influence day-to-day water quality (cause and effect would be difficult to relate). It would be difficult to reliably project, for instance, a 50% improvement in ambient water quality by year 2020 based on stormwater runoff management. However, the observation of long-term trends in ambient water quality will reveal improvements (or degradation) over time. Since the Florida Department of Environmental Protection (FDEP) has an ongoing ambient water-quality monitoring program already, the County should use FDEP data to assess these trends. In addition, criteria for assessing efficacy of stormwater runoff control include the application of BMPs for which known levels of performance with regard to attenuation of bacteria, sediments, nutrients, or other pollutants have been scientifically validated may be assumed to have localized benefit. In addition, it is well established that short-term impacts of stormwater runoff are apparent as spikes in bacterial counts and nutrient levels following storm events. The Task Force recommends that the County use such indices of stormwater management to determine the effectiveness of its stormwater management program.

2.1.1. Inventory and mapping of wetlands and other natural areas

The 1980 Santa Rosa County Soil Survey, Florida Natural Areas Inventory, and other scientific reports shall be used to map and quantify wetlands and other natural areas. Infrared photography and infrared sensing technology can be used for mapping as well as for monitoring.

An updated survey of Santa Rosa County wetlands is currently being conducted through a contract with the Department of Environmental Studies at the University of West Florida (UWF). A Santa Rosa County Environmental Map is required for their Coastal Management Plan and the 5-year required revision of their Comprehensive Plan. Among other things, this map will allow the county to identify areas in which a potential builder will need to get professional help in determining whether he has wetlands on his property that need to be dealt with.

The UWF project will compile a number of published GIS maps and databases from the Florida Geographic Data Library, the Natural Resources Conservation Service, the U. S. Fish and Wildlife Service and other such agencies. Many of these maps as published have different scales and different projections, and therefore they do not overlay correctly. They will be transposed into one scale so that the County can bring any particular place up on the computer and see land cover, vegetation, wetlands, soils, endangered species, and various other potential limiting factors to development. This is a first step to the eventual construction of an actual wetland map for the County.

2.1.2. Identification and characterization of outfalls and hazardous discharges to stormwater systems

Outfalls are defined as those stormwater conveyances with direct discharge to surface waters including wetlands. The Stormwater Master Plan shall identify location, description and size of all outfalls. Fairly precise location of the stormwater outfalls can be accomplished through the use of sub-meter accuracy global positioning system (GPS) units, which will provide reasonably accurate location of stormwater outfalls and tie those locations to state plane coordinates. Additional activities employed to identify and characterize outfalls may be to monitor surface water quality parameters (e.g., nutrients, bacteria, suspended solids) specific for and appropriate to the particular outfall based on land use.

2.1.3. Hazardous discharges to stormwater systems

In order to minimize the risks of contaminants introduced to the storm sewer system, waterways, and water bodies, the County should undertake a program to identify those industries that handle or store potentially hazardous materials. This would apply only to those industries that have not already complied with EPA's stormwater discharge permit requirements for industrial uses. The Stormwater Master Plan shall include identification of

High Risk (high hazard) potential industrial stormwater runoff. The Stormwater Master Plan shall also include identification of non-stormwater discharges to the County stormwater systems such as effluent from septic tanks or sewer systems.

2.1.4. Identification of Areas with Stormwater Quantity Problems

Through a combination of review of County records, interviews with County staff, historical data, public workshops, and citizen questionnaires, the Stormwater Master Plan should identify those areas currently experiencing flooding; The flooding data should be classified according to frequency and type of flooding, i.e. street flooding, yard flooding, flooding of homes or businesses.

Once these data are assimilated, an evaluation should be made of those areas of critical concern by plotting the location of the identified flooding problems on maps with drainage basins maps.

2.1.5 Identify/monitor stormwater runoff from high-risk (high hazard potential) industries not currently covered by a separate stormwater NPDES permit

In order to minimize the risks of contaminants introduced to the storm sewer system, waterways, and water bodies, the County should undertake a program to identify those industries that handle or store potentially hazardous materials. This would apply only to those industries that have not already complied with EPA's stormwater discharge permit requirements for industrial uses.

2.1.6. The countywide stormwater management plan should incorporate basin-specific master plans

Solutions to stormwater quality and quantity problems can often be complex, particularly in urbanized basins.

As part of the development of the County's stormwater management plan, and based on evaluation of the water quantity and quality problems in the County, specific basins will be identified as critical basins. These basins will have identified water quantity and/or water quality problems. In these basins, structural measures (retrofit) will be required in order to address the water quantity and/or water quality problems that exist in the drainage basin. These basins will require in-depth analysis in order to develop alternatives to address those problems. As such, the work effort with regard to hydrologic/hydraulic modeling and solution analysis will be technically demanding. In these critical basins, detailed master plans will be required which identify solution alternatives and costs.

Drainage basins that have no identified problems, but are currently undergoing or scheduled to undergo significant land use changes are prime candidates for consideration of non-structural means of controlling stormwater runoff such as open space preservation, low

density zoning, etc. These basins are also prime candidates for consideration of regional stormwater management facilities. In these basins, hydrologic/hydraulic models should be developed to use as a tool for evaluation of the impacts associated with developments as they occur within the basin.

In largely rural basins, where no identified water quantity or quality concerns exist, and the future land use in the basin is likely to remain rural, the stormwater management plan shall recommend measures to protect, conserve, and potentially improve water quantity and quality in the basin. The stormwater management plan will include specific recommendations and best management practices to be utilized in these basins. These basins will not require detailed master plan development.

2.1.7. Provide cost estimates for remedies for water quantity and quality issues

Solution alternatives to existing water quantity and water quality problems will be required for critical basins in the County. The master plan should identify costs associated with these alternatives to be included in consideration of the funding requirements for the County's stormwater management program. These costs should also include non-structural measures such as purchase and preservation of environmentally sensitive lands.

2.1.8. Concurrent with development of the basin-specific master plans estimate expenditure necessary to implement measures in the master plan, along with potential funding and revenue potential

The management plan should include an operational cost analysis for ongoing stormwater related maintenance activities and an estimate of cost for an improved level of service for each. Based on these results the county can adopt a single or mixture of funding mechanisms for stormwater related activities. The storm water master plans will identify areas in those basins where retrofit is necessary and can provide the optimal and most cost effective benefits for control of both water quantity and water quality.

2.1.9. Establish a County-wide wetland mapping program

A wetland-mapping program should include an assessment of the quality of each identified wetland as it relates to its potential benefits, e.g., for water quality or wildlife habitat. As an adjunct to this program, the County should offer incentives to property owners to enhance the quality of wetlands that have had their functionality impaired by past activities, as well as to encourage maintaining the health and function of unimpaired wetlands. Remedial or maintenance activities such as burning programs or restoration of hydrology should be encouraged.

2.1.10. Develop a program to identify non-stormwater discharges to the County storm sewer system and adopt measures that will provide legal authority to prohibit those discharges and punish offenders.

In order to identify non-stormwater discharges to the stormwater system, the County should implement a dry-weather field-screening program, wherein a portion of the County's outfalls can be reviewed each year in the field for the presence of flow during dry weather. If flow is observed, field screening test kits can be used to test samples of the observed flow and report on the constituents found. Typically, field data collected will consist of descriptive data such as flow, color, turbidity, presence of an oily sheen, or surface scum, and a field analysis conducted with a test kit which identifies certain chemical properties of the observed flow, such as pH, total chlorine, total copper, total phenol, and detergents. Presence of these constituents is an indicator that the observed flow is not stormwater, and that a non-stormwater connection to the system is present in that watershed. These occurrences should be documented and the source of discharge determined.

2.1.11. Stormwater Citizen's Advisory Council

The County shall establish a Stormwater Citizen's Advisory Council, which will be responsible for educating the public regarding stormwater. Development of a public information campaign regarding the potential adverse effects on water quality associated with certain domestic activities shall carried out by County staff as described in the following section on Education. This Council may also provide recommendations concerning monitoring the proper storage, use and disposal of potentially hazardous materials (fertilizers, herbicides, pesticides) that can enter stormwater runoff. It may also suggest changes to Land Development Code that would affect stormwater issues such as setbacks and buffers.

2.2 Public Education

In order for any stormwater program to be effective, the public must be informed and engaged, therefore public education will be a high priority. The public education program should be the responsibility of a Stormwater Citizens' Advisory Council, mentioned above. This council could also serve to monitor progress toward established stormwater quantity and quality goals and prepare progress reports. Additionally, education of stormwater pollution issues will be mandatory in that Phase II of NPDES requires implementation of a public education program.

Stormwater master plan shall create a program to educate the public about stormwater: the hydrologic cycle - how rainfall becomes stormwater, how stormwater picks up contaminants, what determines runoff-impervious area, soil group, the effects of vegetation in the process, moisture content, connectivity, and topography, how flooding occurs. The public will also learn about the benefits of techniques to decrease stormwater problems: native vegetation buffers, xeriscaping (landscaping with native species), minimal use of pesticides, herbicides, and fertilizers, use of pervious surfaces, tree protection, proper disposal of hazardous household wastes.

Potential Sources of Information

- Brochures, billboards, and other printed materials
- Videos
- TV Shows Blab / Ch. 27
- Radio shows
- Newspaper articles and supplements
- Presentations to citizens and professional groups
- Web site
- County Demonstration Areas:
  All County projects will use the best available techniques for construction and landscaping to minimize stormwater problems. These will serve as an example for the public to follow in residential and commercial projects.
- Partnerships with schools, church groups, environmental organizations, garden clubs, etc. on native vegetation demonstration projects
- Education materials will be available at permitting agencies
- County Extension agencies and organizations

2.3 New Construction

New construction should ideally mimic the preexisting natural system. Studies have shown that no structural stormwater systems are as effective as natural infiltration. In addition, all new construction should be encouraged to decrease the amount of impervious surface. There is a direct correlation between amount of impervious surface and amount of stormwater runoff.

The Task Force recognizes that it is preferable to prevent stormwater runoff problems during new construction to retrofitting completed developments with updated stormwater control facilities. This is because it will always be easier, less costly, and more aesthetically agreeable to ensure effective stormwater control during new construction than later. Whenever structural solutions are implemented, the County should institute a policy of follow up inspections of constructed stormwater management features. Such inspections should be conducted periodically and after severe storm events to ensure proper maintenance and functionality of these facilities.

2.3.1 Design Flexibility

The purpose of design flexibility is to implement stormwater control and wetland preservation incentives within the context of zoning and development review. Below are some incentive based approaches that can be implemented by amending the County's current Land Development Code **(APPENDIX VI)**. Similar to Planned Unit Development (PUD) or Planned Business Development (PBD), these mechanisms would require specific pre-development conceptual conferences as well as application approval. Issues on incompatibility would have to be resolved prior to any approval of cluster development, or density transfer. Ideally density transfers will not increase densities within 1000 feet of surface water in the flood plain, and coastal high hazard area.

- Designing with Nature – This refers to a method of subdivision and site design, which encourages conservation of natural wetland features. This should be the ultimate goal of stormwater management.

- Cluster Development or Density Transfer – This refers to the implementation of more flexible zoning and density standards when a developer chooses to keep development out of wetland or flood prone areas. This would entail setback (similar to PUD mechanisms) and density modifications that would enable a subdivision developer to arrive at a comparable number of units without impacting natural features thus providing a financial incentive to design the project in a desirable way.

- Stormwater Facilities as Amenities – For the most part this would involve the utilization of the above-mentioned incentives to encourage the development of stormwater facilities that could be identified as neighborhood or development amenities. The use of the Stormwater Master Plan to identify regional stormwater

facilities that could be utilized as community-wide amenities would also fit this scenario.

2.3.2 Buffer zones

This refers to leaving a naturally vegetated or planted buffer strip between wetlands or other water bodies in order to protect them from development. Benefits from buffers include trapping and removing sediment, nutrients and contaminants from runoff, stabilizing stream banks and reducing erosion, reducing property damage by storing flood waters, protecting water quality, and providing wildlife habitat. **APPENDIX VII: Executive Summary of Review of Scientific Literature on Riparian Buffers (Wenger, 1999)** and **APPENDIX VIII: Executive Summary of Model Ordinance Protecting Stream and River Corridors: Creating Effective Local Riparian Buffer Ordinances (Wenger and Fowler, 2000) (full model ordinance document is available within ATTACHMENT)** provide additional relevant information on buffers. Both of these documents may be found and printed at www.cviog.uga.edu/pprs/papers.htm.

2.3.3. Pervious Surfaces

Benefits of increasing the area of pervious surfaces may seem intuitively obvious. If rainwater is absorbed into the surface on which it falls, and does not run off carrying pollutants, then it is not a stormwater runoff problem. The use of porous paving on rights-of-way and light-use roads, grass filter strips, roof gardens, and numerous other inexpensive approaches can greatly reduce the problem of stormwater runoff at the source (Delaware Riverkeeper Network, 2001; copies of this document are available within **ATTACHMENT**). Subsequent segments of this report, and **APPENDIX IX** that deal with BMPs applicable to stormwater runoff provide additional examples and describe specific applications.

2.3.4. Tree Preservation

Benefits provided by trees include flood control, erosion control, wildlife habitat, water supply protection, pollutant filtering, water and air quality enhancement and increased property values. Studies have also shown the important role that trees perform in stormwater management. A recent American Forests' regional analysis studied a 7,000 square mile watershed in Washington, documenting changes over a 24-year period. During this period heavily forested areas declined by 37 percent, while stormwater flow increased by 29 percent, an increase of 1.2 billion cubic feet of runoff. Considering the average cost of building stormwater storage facilities is nearly $2/cubic foot, the value of lost tree cover in this study in terms of stormwater benefit alone was 2.4 billion, or 100 million dollars per year.

Tree preservation is regulated by the Santa Rosa County Tree Ordinance. Recommendations for improving the Tree Ordinance are in Section 4.1. An example of a tree ordinance outline developed by scientists and businesses is in **APPENDIX X** (*Guidelines for Developing and*

Evaluating Tree Ordinances; this document may be found within **ATTACHMENT** and it may be downloaded in its entirety at http://www2.champaign.isa-arbor.com/tree-ord/index.htm

2.3.5. Regulatory Approaches for Protecting Water Quality

- **Buffering –** This refers to the implementation of a mandatory requirement to leave a naturally vegetated or planted buffer strip between development and other significant water bodies in order to protect them from development run-off. The current Santa Rosa County Land Development Code does include provisions for environmental buffering, which are set out in Section 12.01.00 of the LDC **(APPENDIX XI)**.

The Task Force recommends the use of naturally vegetated buffer strips that are as wide as practicable in new construction, as such practices improve the quality of stormwater runoff (See **APPENDIX VII**). The County should select a committee to examine the widths of such strips and evaluate them on a case-specific basis.

- **Setbacks –** This refers to the "setting back" of buildings or other building related improvements from a water body. The current Santa Rosa County Land Development Code requires provides for setbacks along the Gulf, Santa Rosa Sound, Escambia Bay, East Bay, and Blackwater Bay as described in **APPENDIX XI**.

The Task Force recommends that the same committee that evaluates buffer strips should also be changed with ruling on setbacks on a case-by-case basis. This committee should consider and suggest changes to the principles of design flexibility and variances that can be incorporated into the County Land Development Code.

2.3.6 Best Management Practices (BMPs)

Best Management Practices (BMPs) — Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters. These practices and procedures limit the impact to the environment.

Typically, the term Best Management Practices (BMPs) refers to a practice or combination of practices that, based on sound science and best professional judgment, are determined to be the most effective and practicable means of reducing nonpoint source pollution and improving water quality. Both economic and technological considerations are included in the evaluation of what is practicable. BMPs may include structural controls (retention or detention ponds, for example) or non-structural controls (source control or pollution prevention, for example). Many BMPs have been developed for urban stormwater, both to reduce pollutant loadings and reduce peak flows. These BMPs accommodate site-specific conditions, including soil type, slope, depth to groundwater, and the designation of receiving waters. **APPENDIX IX** is a more detailed treatment of BMPs as applied to stormwater runoff issues.

2.3.7 Total Maximum Daily Loads (TMDLs)

Non-point source pollution from stormwater runoff of urban, suburban and rural landscapes is recognized as the dominant loading vector for sediments, nutrients, and synthetic chemicals to surface waters of freshwater, estuarine, and coastal marine environments. As regulators are pressured into complying with the Clean Water Act, total maximum daily loads (TMDL) of materials carried by stormwater runoff are being pursued. TMDLs will be priority water-quality criteria for effective management of all sources of pollutants entering waterways as part of the National Pollution Discharge Elimination System (NPDES) program in the Clean Water Act. The U.S. Environmental Protection Agency (EPA) has given notice that they intend to enforce existing NPDES regulations and to mandate development of TMDL standards for surface waters in compliance with the Clean Water Act. Section 305(b) of the Clean Water Act requires that states calculate TMDLs for each of the impaired water bodies (Paulic et al., 1996). These impaired water segments within Santa Rosa County are included in the "303(d)" list (**APPENDIX XII**). The Florida Watershed Restoration Act (Guillory and Sear, 1999; State of Florida, November 1999; Senate Bill 2282er) is Florida's response to TMDL mandates. The Florida Department of Environmental Protection (FDEP) formed Technical Advisory Committees for the definition and for the allocation of TMDLs for the State of Florida the findings of which have been report to the Florida Legislature and are available on the Internet (http://www.dep.state.fl.us/water/tmdl/303drule.htm).

2.3.8 Wetland Mitigation Bank

Wetland Mitigation Banking: Wetland Mitigation Banking allows the destruction of wetlands in return for the purchase of other wetlands, ideally within the same drainage basin, at ratios ranging from 4 to 30 acres of preserved wetlands for each acre of wetlands destroyed. The FDEP currently regulates this practice. Wetland Mitigation Banking was approved by the legislature in the mid 1990's and has been little used in Northwest Florida most likely due to its poor economic return. Santa Rosa County oversees proposed development under the land development code. The Task Force believes the evaluation of any proposed Wetland Mitigation Banking Projects should be left to FDEP at this time.

2.3.9 Septic Tanks

All septic tank installations in new construction are currently subject to permitting requirements in Santa Rosa County's Land Development Code. Although previous committees have reviewed the issue of more stringent requirements for Septic Tanks on several occasions, we believe septic tanks still exist in sensitive environmental areas that impact surface water quality. The Santa Rosa County Stormwater Task Force urges the County Commission to review again current regulations that allow existing development to operate septic tanks in environmentally sensitive areas especially where connection to sanitary

sewers is available. All septic tank installations in new construction are subjected to permitting by the Santa Rosa Health Department.

2.4 Retrofit (dealing with the mistakes of the past)

Retrofitting is the process of bringing existing developments up to performance levels of stormwater runoff control expected of new construction. Typically retrofitting of stormwater controls is far more costly than implementing such controls in new construction. That is in part due to the fact that existing buildings, roads, bridges, and other structures may render some types of BMPs impractical. However, there are many retrofit solutions, such as adding infiltration trenches and depressed vegetation islands in parking lots that are very effective and relatively inexpensive.

However, where possible, the County should retrofit using natural systems (as above). The finance of these improvements could be accomplished with a system of fees based on total impervious surface, with credit for total area in native vegetation. The Task Force recommends that the County work with the Florida Department of Transportation to correct direct discharge to surface waters. And septic tanks sited in inappropriate soils or too near surface waters with central sewer connections should be replaced.

2.4.1 Incentives

The County should adopt incentives for new developments and for those existing residences, for agricultural operations and for businesses whose properties immediately adjoin water bodies to encourage participation in a program to restore the riparian shoreline, and provide treatment of stormwater from lawns and encourage alternate vegetative plantings of native species, minimizing or eliminating the use of fertilizers for lawns.

2.4.2 Paving Dirt Roads

This program will include an accelerated paving program for dirt roads. The road paving will consider incorporation of stormwater treatment measures that meet or exceed the requirements of FAC 62-25.

There are thousands of miles of dirt roads in Santa Rosa County. When properly maintained, many sections of these roads contribute very little to our stormwater problems. However, the most serious stormwater problem associated with dirt roads in Santa Rosa County is associated with wetland road approaches. A wetland road approach is defined as a road that approaches creeks, rivers, or other wetland areas, with many of these approaches down slope. The erosion that occurs in these areas accounts for a high percentage of sedimentation and increases county road maintenance costs. Other costs due to roadway erosion include

increased flooding, impaired waterway navigation, loss or impairment of stream or river recreational areas, loss of fisheries and other riparian zone natural resources, adverse effects on the natural food chain, and loss of aesthetics which can lead to negative impacts on tourism and general business growth (Choctawhatchee, Pea and Yellow Rivers Watershed Management Authority, 2000).

An example of a large piece of public land in Santa Rosa County with a high percentage of dirt roads is Blackwater River State Forest. The Florida Division of Forestry has done an outstanding job of managing this forest for more than 50 years. This is particularly true considering the limited resources available for management activities such as road maintenance. A recent road survey completed at Blackwater River State Forest identified 1,702 total miles of road. Of this total, 89% of the roads were dirt or gravel. Over 80% of the roads are below grade. Of the total mileage of roads, however, only 12% (208 miles) of the roads are wetland road approaches. Of these approaches 20% have already been paved. The Blackwater survey, which clearly identified road condition and wetland approaches, will greatly assist the State Forest in making the best use of very limited resources by first prioritizing work on those 12% of roads that have negative stormwater impacts.

It is also evident when discussing road-paving needs in Santa Rosa County that needs far exceed funding. Thus, it will be very important for the County to establish a priority listing of wetland road approaches that either require the highest level of maintenance and/or have the highest negative impact to the wetland system. The Task Force recommends that the first step be establishment of a priority listing of the condition of wetland road approaches through completion of a countywide dirt/gravel road and wetland crossing survey. The most damaging approaches are evidenced by an entrenched or below grade road, turning the road into a gully during rain events. Limited funding also makes it difficult to maintain both wetland road approaches and wetland crossings such as culverts, bridges or low water crossings. Choosing an appropriate crossing and stabilizing the area with vegetation is just as important as the paving of the approaches.

Recognizing the stormwater impacts associated with managing dirt roads and the limited funds available to improve them, the Task Force recommends a priority paving system that centers funding initially on the most critical sections of dirt roads, the sections that approach creeks, rivers and wetlands. This type of paving is called “hilltop to hilltop” paving. Paving the wetland road approaches and vegetating the ditches and slopes greatly reduces or eliminates the unnatural input of sediment, a major contributor of non-point pollution in our County. Vegetation is critical in holding the soil together to protect the paved road. For example, instead of paving an eight mile section of dirt road with two steep creek crossings, “hilltop to hilltop” paving would instead lead to paving only of the 1/8 mile on each side of the two creek crossings for a total of ½ mile of paving. By paving in this way, and having an appropriate crossing, the serious stormwater problems are then addressed, saving the county maintenance dollars and reducing environmental damage. As additional funding is generated, other road sections outside of the “hilltop to hilltop” area may then be paved.

The Task Force recommends the completion of a countywide road and wetland crossing survey, using stormwater impact criteria, and that the County pave prioritized road sections "hilltop to hilltop."

2.4.3 Maintenance of Roads

The Task Force recommends that the County develop procedures for maintenance of roads that will minimize erosion potential and the transport of sediments into adjacent water bodies and wetlands. See ***Recommended Practices Manual, A Guideline For Maintenance And Service Of Unpaved Roads***. Copies of this document are available within **ATTACHMENT**.

2.5. Agriculture

The Task Force recommends that the County develop a program that emulates or is in accord with Federal guidance designed to minimize the use of herbicides, pesticides, and fertilizers (nutrients) as part of the County's overall maintenance plan.

2.5.1. Nutrient Management

Nutrient Management is managing the amount, source, placement, form, and timing of the application of nutrients and soil amendments. This practice may be applied as part of a resource management system to support one or more of the following purposes:

- To budget and supply nutrients for plant production.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To minimize agricultural nonpoint source pollution of surface and ground water resources.
- To maintain or improve the physical, chemical and biological condition of soil.

Conditions Where Practice Applies:

This practice applies to all lands where plant nutrients and soil amendments are applied except for small plots where nutrient and soil amendment application is limited (e.g., wildlife food plots less than one acre).

2.5.2. Pest Management

Pest Management is managing agricultural pest infestations (including weeds, insects, and diseases) to reduce adverse effects on plant growth, crop production, and natural resources.

This practice may be applied as part of a conservation management system to support one or more of the following purposes:

- Control pest to the economic threshold level.
- Protect water quality.
- Protect human health.
- Protect plant and animal health.

Conditions Where Practice Applies:

On cropland and other agricultural land where pest control is needed.

In Santa Rosa County agricultural producers are required to have Nutrient and Pest Management Plans on all agricultural land that receives USDA program benefits.

2.5.3. Buffer Zones in Agricultural Practice

Buffer Zones are areas of the herbaceous vegetation situated between cropland, grazing land, or disturbed land (including forest land) and environmentally sensitive areas. The use of buffer zones may be applied as part of a conservation management system to support one or more of the following purposes.

- To reduce sediment, particulate organics, and sediment adsorbed contaminant loadings in runoff
- To reduce dissolved contaminant loadings in runoff
- To reduce sediment, particulate organics, and sediment adsorbed contaminant loadings in surface irrigation tailwater
- To restore, create or enhance herbaceous habitat for wildlife and beneficial insects
- To maintain or enhance watershed functions and values

Conditions where practice applies:

This practice applies in areas situated below cropland, grazing land, or disturbed land (including forest land) (1) where sediment, particulate organic matter and/or dissolved contaminants may leave these areas and are entering environmentally sensitive areas; and/or (2) in areas where permanent vegetative establishment is needed to enhance wildlife and beneficial insects, or maintain or enhance watershed function. This practice applies when planned as part of a conservation management system.

2.5.4 Agricultural BMPs

Properly designed and implemented BMPs have been shown to be effective, reasonable tools for controlling potential nonpoint source water quality impacts associated with agricultural production. However, it is critical in the development and implementation of agricultural BMPs that they are compatible with the agricultural activity for which they are intended and that they strike a balance between water quality improvement and agricultural productivity.

Recognizing the increasingly important role that BMPs will play in the future as TMDLs are established and loads subsequently allocated, several sectors of Florida's agricultural industry have already worked in a proactive manner to develop and adopt BMPs. Presently in Santa Rosa County all agricultural producers that participate in USDA programs have detailed conservation plans. Furthermore, the producers that are participating in the Environmental Quality Incentives Program (EQIP) have pesticide and nutrient management plans. These BMPs are listed and discussed in **APPENDIX IX**.

2.6. Revenue

2.6.1. Revenue requirements

Revenue requirements to meet adopted levels of service will be established in the Master Plan. A number of funding sources will be considered and evaluated for revenue potential. Funding sources to be evaluated at a minimum shall include grants (private, state, and federal), stormwater utilities, Municipal Service Benefit Units (MSBUs), impact fees, optional sales tax, and ad valorem tax increases. The results of this evaluation should be incorporated into a separate report in the Master Plan, titled "Funding for Stormwater Management". Funding requirements for stormwater will consider operation and maintenance costs, in addition to required expenditures for stormwater capital improvements. As part of the effort to estimate revenue requirements, the County must Identify and provide cost estimates for both structural and nonstructural remedies for water quantity and quality issues in those specific basins.

2.6.2. Funding sources

A variety of federal and state programs provide block grant for specific stormwater projects. Federal agencies such as the United States Army Corp of Engineers, United States Department of Agriculture, United States Fish and Wildlife Service, National Oceanic and Atmospheric Administration, Environmental Protection Agency, Department of Transportation, and Department of the Interior may all provide grants for specific stormwater projects. However, these agencies will only provide monies for specific projects and Santa Rosa County staff personnel must invest their time and resources to prepare grant proposals to obtain funding from these various federal agencies in a very competitive environment. It has become apparent to the Santa Rosa County Stormwater Task Force that many of the recommendations made in this document will be useless without a reliable funding source. Based on presentations made to the committee, one of the most reliable sources of revenue appears to be the creation of a stormwater utility. In general a stormwater utility would assess individual residents and businesses a fee based on the amount of impermeable surface that exists on their property. The reduction of impermeable surface area would reduce one's fee and would be an inducement to limit paved areas that create stormwater. Various formulas exist to determine applicable fees and who pays at what rate. The value of a stormwater utility will have to be demonstrated to the public and extensive citizen involvement will be required to arrive at a fair and equitable formula for the assessment of any stormwater fees. Another source of funding is an increase in the countywide sales tax. A portion of the sales tax dedicated to improving stormwater run-off would not require the creation of a new bureaucracy and could be managed by current county staff.

3. Legislative Actions (both state and local)

The Task Force suggests that the below items may be usefully addressed by legislation at the state or local level as appropriate.

3.1. Maximize use of natural features/systems in all land use categories to include the following:

- Buffer zones of undisturbed native vegetation, including forested buffers, around all surface waters and wetlands should be encouraged by County ordinance in accord with principles described above in **Section 2.3.5** on a case by case basis.
- Encourage shoreline vegetation for stabilization instead of hard structures.
- Vegetated filter strips, field borders and sediment basins
- Vegetated, curvilinear, open stormwater drainage
- Recreational space design and utilization for stormwater control
- Native vegetation buffers for separation of differing land uses
- Effective tree ordinance to protect all native species but not exotics, applicable to all land use categories
- Effective erosion control during and after land disturbance and construction by immediate use of groundcovers and, where needed, reinforcement

3.2. Direct population growth away from wetlands and coastlines.

The Task Force encourages legislation that would maintain public access to surface waters while discouraging high-density development of wetlands and coastlines. This is beneficial for hurricane evacuation or sheltering, for wider local and tourist recreation use, and for improvement of water quality and safety.

- Acquisition of properties and development rights by State, Federal or County government programs or by conservation non-governmental organizations
- Prohibit zoning density increases within floodplains, coastal high hazard areas, or 1000’ of surface waters and wetlands, whichever is greater

3.3. General measures to prevent stormwater problems.

- Mandate anti-backflow devices on potable water systems
- Work with wastewater utilities to minimize inflow and infiltration
- Prohibit new dirt roads
- Discourage septic tank systems in wetland areas
- Implement tax incentives/disincentives to maximize areas of native vegetation and low impact cultivation and pervious surfaces throughout the County
- Minimize tax on undisturbed, undeveloped land
- Encourage pervious materials where paving is needed
- Encourage landscaping with native plantings and groundcovers
- Encourage certified organic farming practices

3.4. Environmental Resource Permitting (ERP)

It is the recommendation of this Task Force that the Santa Rosa County Commission pass a resolution to support the immediate implementation of Environmental Resource Permitting (ERP) with the Bert Harris Act exemption for Northwest Florida in the state legislature. The Bert Harris Act applies to all new legislation passed after 1995. An exemption to the Bert Harris Act would allow Environmental Resource Permitting in Northwest Florida to operate in the same manner as in the rest of the state, which has had ERP prior to 1995.

Additionally, by unanimous vote of 13-0, the Natural Resources Advisory Committee recommended that the Florida Legislature speed up the implementation of the ERP Program, exempt from the Bert Harris Act, in Northwest Florida as soon as possible to provide adequate natural resource protection. The Advisory Committee's understanding is that the Northwest Florida Water Management District (NWFWMD) already has the statutory authority to implement the ERP Program, and that they only need to begin the rule-making process and receive a legislative appropriation to fund the Program until such time as their millage rate increases. Therefore, the Advisory Committee sees the possibility of implementing ERP in Northwest Florida as soon as possible. This will provide the citizens of Northwest Florida the same level of natural resource (wetland and stormwater) regulation that the citizens in the rest of the state receive. Not only is this fair and equitable for all of Florida's citizens, it is the action that the Advisory Committee feels is required to protect the natural resources in Northwest Florida. In light of the recent U.S. Supreme Court decision that

potentially leaves isolated wetlands in Northwest Florida with no regulatory jurisdiction at all, the Advisory Committee feels that it is imperative that the state of Florida "step up" and provide isolated wetland regulation in Northwest Florida through the ERP Program.

4. Enforcement of Existing Ordinances / Permitting

The County must provide means for enforcement of existing ordinances and permitting capabilities. Such means should be defined within the Master Plan and funds should be budgeted to ensure that sufficient personnel and material resources are available. This may involve establishing an office of "stormwater permitting and code enforcement," and a support staff to inspect new development….

4.1. Tree ordinances

- Tree Preservation Ordinances —Tree ordinances are recognized across the United States as an important tool in maintaining healthy and diverse community forests. However, tree ordinances do not take the place of a comprehensive community forestry program and management plan. It is because of this recognition that the Task Force recommends the creation of a Santa Rosa County Tree Ordinance and Management Plan Review Committee. The committee should consist of business and community leaders, scientists, and concerned citizens from Santa Rosa County. . It is also recommended that a well-developed plan or outline be used to guide the committee. One such outline has been completed by a respected group of businesses and scientists from the International Society of Arboriculture (see "Guidelines for Developing and Evaluating Tree Ordinances" found http://www2.champaign.isa-arbor.com/tree-ord/index.htm). It is recommended that an improved ordinance also include development of incentives for tree preservation, regardless of zoning or use of the property.

Recommended members of the Santa Rosa County Tree Ordinance and Management Plan Review Committee include

- John Davy — Panhandle Growers
- Dr. Mack Thetford — University of Florida
- Dr. Eleanor Williams — Go Native Nursery
- Vernon Compton — The Nature Conservancy
- Kristen Andersen — Santa Rosa County Planning Director
- Dr. Richard A. Snyder — University of West Florida
- Dan Mullins — Santa Rosa County Horticultural Extension Agent
- Ken Oser — Forester
- Paul Humbert — Florida Native Plant Society
- Jerry Bennett — Cardinal Development
- Jerry Wilson — Real Estate Appraiser & Broker
- Tom Waite — Waite Development

A facilitator funded by Santa Rosa County who will also compile and write the final report should lead the Committee. The facilitator should be familiar with the scientific principles of tree management. It is recommended that the Committee consist of 15 or fewer members to

allow for efficiency and productivity. A goal should be to complete the review and recommendations within this year to allow for incorporation in the County Comprehensive Planning Process.

APPENDICES

APPENDIX I: Presentations During Proceedings of the Task Force

Presenter	Organizational Affiliation	Presentation Subject
Steve Duncan	USDA Natural Resource Conservation Service	Conservation Projects in Santa Rosa County
Keith Wilkins	Director, Escambia County Neighborhood & Environmental Services	Escambia County Stormwater Task Force Committee
Joe Eugene Lepo	University of West Florida	Escambia County Stormwater Task Force Committee
Cliff Street	Florida Department of Environmental Protection (FDEP)	Current FDEP concerns, possible goals
Mike Lewis	Environmental Protection Agency	Current EPA concerns
Ronald Bartel	Director of Resource Management, NWFWMD	Northwest Florida Water Management District (NWFWMD) Stormwater issues
Paul Thorpe	Associate Water Resource Planner, NWFWMD	Northwest Florida Water Management District
Grady L. Marchman	Chief, Bureau of Surface Water	Other Master Stormwater Management Plans
Eric Livingston	Bureau of Watershed Management, FDEP	"Be Part of the Solution to Pointless Personal Pollution"
Eric Livingston	Bureau of Watershed Management, FDEP	"Florida's Rotation Basin Approach: Towards Better Integration, Coordination, and Cooperation"
Eric Livingston	Bureau of Watershed Management, FDEP	"Keys to Successful Stormwater Program Implementation"
Hunter Walker	County Administration	Stormwater Utility Web Sites provided by Lee Marchman of the Water Management Bureau
Mike Donahoe	Santa Rosa County Extension Services	Best Management Practices on Agricultural Land
Mickey Diamond	Local Farmer	Best Management Practices on Agricultural Land and Practices Farmers use Today
Kurt Spitzer	Executive Director of the Florida Association of Stormwater Utilities	
Duncan Rose	Parsons Engineering Science	"User Charge/Assessment", rates, discounts, and exemptions
Kristen Andersen	Zoning and Planning Director	Comprehensive Plan
Roger Blaylock	County Engineer	LDS stormwater regulations; outfall inventory; mitigation strategy; other projects
Oscar Miller	Santa Rosa County resident	Stormwater problems that exist in Thomastown Estates
Vernon Compton	Nature Conservancy	"An Inexpensive Stormwater Management Solution"

APPENDIX II: Biographical Sketches of Task Force Members

Santa Rosa Stormwater Task Force

Geoffrey (Geoff) Maddux served as the chairman of the Task Force. He is a 1984 graduate of Illinois State University with a BS in Geology. He worked briefly for two years in the oil industry for Dresser Atlas, a wireline service company, and started working for Woodward Clyde Consultants, an environmental/civil engineering consulting firm in Tallahassee, in 1986. He has worked for environmental consulting firms in Tallahassee, Ocala, and Pensacola over the last fifteen years specializing in water resource investigations, assessment and clean up at various hazardous waste and petroleum facilities throughout the southeast. He started his own environmental consulting firm in 1997 and conducts projects throughout Northwest Florida and South Alabama. Mr. Maddux is the former president of the Navarre Beach Leaseholders and Residents Association (NBLRA) and has been involved in the NBLRA's efforts to promote responsible environmental practices to lessen development's impact on the beach's ecosystem. Geoffrey L. Maddux is married to Debbra with two sons.

Vernon Compton currently works for The Nature Conservancy as Project Director of the Gulf Coastal Plain Ecosystem Partnership. He has a Bachelor of Science in Forest Management from Louisiana State University and previously worked for the Florida Division of Forestry at Blackwater River State Forest for 8 ½ years. The Gulf Coastal Plain Ecosystem Partnership is a voluntary landowner partnership formed in 1996 to sustain over 910,000 contiguous acres of longleaf pine habitat and portions of four major watersheds in northwestern Florida and southern Alabama. The six partners are Eglin Air Force Base, Florida Department of Environmental Protection, the Florida Division of Forestry, the Northwest Florida Water Management District, National Forests in Alabama, International Paper, and The Nature Conservancy. The partnership allows the partners to combine their expertise and resources to more effectively manage their individual properties and to meet the challenges of sustaining the larger ecosystems. He has resided in the City of Milton for over 10 years.

Carla Cook (no biographical information available).

Steve Duncan is the District Conservationist with the United States Department of Agriculture, Natural Resources Conservation Service, in Milton, Florida. He has an Associate in Arts from Tallahassee Community College, and a Bachelor of Science (Soil Science and Agronomy), from Florida A&M University. He served in the U. S. Army. He has over 25 years of professional experience in soil Conservation and is a member of the Soil and Water Conservation Society. He currently directs the field office operations and provides technical assistance to individuals and groups of farmers and other landowners in the development, application and maintenance of soil and water conservation plans under various programs including the Environmental Quality Incentives Program, Conservation Reserve Program, Forestry Incentives Program and the Emergency Watershed Program.

Frances Dunham has lived in Santa Rosa County since 1974. She received a B.F.A. in drawing from the University of Arizona, Tucson and a Master of Fine Arts in printmaking from Southern Illinois University, Carbondale. She has taught studio art and art history at the University of West Florida, Pensacola Junior College, Okaloosa-Walton Junior College, and the State University of New York, Geneseo. She also has been a self-employed graphic designer, illustrator, and calligrapher since 1976. Ms. Dunham is a founder and board member of two Pensacola area environmental groups, Citizens Against Toxic Exposure since 1992 and Santa Rosa Sound Coalition since 1995. She has written articles and given presentations on Superfund cleanup (including Congressional testimony on Superfund reauthorization), toxics use reduction, environmental justice, health study protocol evaluation, wastewater issues, and water quality.

John P. Harper is Three Rivers RC&D Council, Projects Coordinator, with the United States Department of Agriculture in Milton, Florida. He has a Bachelor of Science degree from Auburn University in Agricultural Economics. He has over 25 years of professional experience in conservation in Alabama and Florida. He currently directs Resource Conservation and Development projects of 7 counties in West Florida including, Escambia, Santa Rosa, Okaloosa, Walton, Bay, Washington, and Holmes counties. He assists local communities with the development and funding of conservation projects in West Florida. He served as the past president of Soil Water conservation society in Alabama and he currently serves as a member of the Auburn University Agriculture Alumni Board.

Kathie Martin (no biographical information available)

Alan M. Miller, P.E. is a 1986 graduate of Auburn University with a Bachelor of Science Degree in Agricultural Engineering and a 1995 Graduate of the University of South Florida with a Master of Engineering Degree in Civil/Environmental Engineering. He worked for twelve years as an engineer for the U.S. Navy at NAS Pensacola and NAS Whiting Field. He is currently self-employed as a local private consulting engineer specializing in Civil/Environmental projects including potable water distribution systems, sanitary sewer collection systems, stormwater management designs, and erosion control projects. Mr. Miller is currently a member of the Florida Engineering Society and the National Society of Professional Engineers. He is a lifelong resident of Santa Rosa County.

Wayne Newsome, P.E. is a Graduate of University of Florida in 1978 with a Bachelor of Science Degree in Civil Engineering. He has over 20 years experience in the stormwater/stormwater management field. He has been involved in numerous stormwater master-planning efforts. Mr. Newsome has worked as a hydraulic engineer with the Corps of Engineers, Mobile District, Environmental Engineer with Leon County, and has worked as a professional engineer with CarlanKillam Consulting Group, Inc. the last 14 years, where he is currently employed as Director of Civil Engineering for the Pensacola office. He is active in the Northwest Florida chapter of the Florida Engineering Society where he served as chapter president in 1993-94. He was the chapter's Young Engineer of the Year in 1991. He is currently serving on the Governmental Affairs Committee of the local chapter. He is a Paul Harris Fellow with the Gulf Breeze Rotary Club and will serve as Community Service Director in the coming year. He is a certified Toastmaster in the Ellyson Park Toastmasters club. He is a member of the Gulf Breeze United Methodist Church, where he sings in the choir. He is married with a daughter who is currently a junior at Auburn University.

Jack Sanborn is a Graduate of University of Florida in 1972 with a Bachelor of Science in real estate. He served as a US Marine Corps helicopter pilot and instructor at Whiting Field, Naval Air Station. He has been an active steward of the forests and streams of Santa Rosa County. He serves as President of Adventures Unlimited Outdoor Center and a Boy Scout Assistant Leader. He was past-president of the Santa Rosa Historical Society; Co-Chair of Rail Trail; Commissioner on Florida Tourism Commission. He is a swimmer, hiker, kayaker, father, husband, and environmentalist.

Enid Sisskin, Ph.D. resides in Gulf Breeze, Florida. She holds a M. Phil. and Ph.D. in pathobiology from Columbia University, an M.S. in Biology from Southern Illinois University, and a B.S. in Biology from Queens College —City University of N.Y. She did postdoctoral work at the National Institute of Environmental Health Sciences (National Institutes of Health). She has conducted research and served as a Resource Management Specialist in the Everglades National Park. She has had a high interest in environmental issues for many years manifest as writing environmental columns for local newspapers and currently serves as Environmental Activist with the Gulf Coast Environmental Defense in Pensacola, Florida.

Joe Eugene Lepo, Ph.D. served as technical advisor for the Task Force as well as report editor. He is currently Associate Professor of Microbiology within the Center for Environmental Diagnostics and Bioremediation and Department of Biology at the University of West Florida. He received a BS in biology and MS in microbiology from Pittsburg State University of Kansas and a Ph.D. in microbiology and biochemistry from the University of Texas at Austin. He did postdoctoral work at the Laboratory for Nitrogen Fixation Research at Oregon State University, Corvallis. Subsequently, Lepo took a faculty position in the Department of Biology at the University of Mississippi; while there, he was awarded a Senior Fulbright Research Fellowship at the University of Helsinki, Finland; he was awarded tenure. He worked for three years with the biotechnology firm ECOGEN, Inc. before returning to University of Mississippi and then to the University of West Florida. His most recent research interests include biodegradation of petroleum hydrocarbons, the regulation and application of biological surfactants and environmental water quality. He has authored or co-authored over 60 peer-reviewed scientific articles, and numerous book chapters and technical reports.

APPENDIX III: NPDES Programs

Phase I of the National Stormwater Program provides for the regulation of stormwater discharges in the following five categories:

- Discharges permitted before February 4, 1987 for ten industrial categories through existing NPDES discharge permits.
- Discharges from Industrial Activity not previously permitted (including Construction Activity on land areas five acres or larger).
- Discharges from Large Municipal Separate Storm Sewer Systems (MS4s). An MS4 serving a population of 250,000 or more is considered large based on 1980 census data.
- Discharges from Medium MS4s serving a population of 100,000 or more, but less than 250,000.
- Discharges which the Director of the NPDES Program designates as contributing to a violation of a water quality standard or a significant contributor of pollutants to waters of the United States.

The EPA adopted rules in 1990 and 1992 which implemented Phase I of the NPDES permit program for stormwater discharges by establishing individual and general permits for discharges associated with industrial activity and construction sites five acres or larger. The EPA individual and general permit rules provide for a Notice of Intent (NOI) and Storm Water Pollution Prevention Plan (SWPPP) be submitted for each regulated facility. Several industrial complexes and Peter Prince Airport in Santa Rosa County maintain a SWPPP. Phase II of the National Storm Water Program was originally scheduled to begin October 1, 1992, however, delays in implementing Phase 1 and completing required studies for Phase II delayed the program until December 8, 1999.

NPDES Phase II rules require permit coverage by March 10, 2003 for industries, municipalities and construction activities disturbing one or more acres of land. Phase II rules have taken a more flexible approach to stormwater than Phase I rules. Municipalities regulated under Phase II will not be required to conduct analytical testing to establish stormwater quality. They will be required to implement best management practices (BMPs) to meet compliance with six minimum measures. A municipality's individual permit application or notice of intent for coverage under a general permit must include descriptions of BMPs and their respective measurable goals that will be used to comply with the following measures:

- Public Education and Outreach. This measure must include a program to educate the public on the impacts of stormwater on receiving waters and what can be done to prevent stormwater pollution.

- Public Participation/Involvement. This measure must include a procedure to give the public an opportunity to participate in the development and implementation of a stormwater program.
- Illicit Discharge Detection and Elimination. Municipalities must develop and implement a plan to locate and eliminate discharges into storm sewers from any sources other than stormwater. This would include a map of outfalls and locations of stormwater conveyances.
- Construction-Site Runoff Control. Municipalities must have regulations in place for erosion and sediment control as well as BMPs to reduce and prevent other pollutants associated with construction activity from entering water bodies through stormwater runoff.
- Post-Construction Runoff Controls. Municipalities must have regulations in place requiring new and redevelopment projects to implement and maintain runoff controls to reduce pollutant loads in stormwater runoff.
- Pollution Prevention and Good Housekeeping. Municipalities must have an operation and maintenance program to prevent or reduce pollutant runoff from stormwater runoff from their operations.

APPENDIX IV: Definition of Terms

Best Management Practice (BMP) — schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States; BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Buffer Zone — an area of undeveloped land, usually with natural vegetation intact, between a development and a body of surface water

Clean Water Act — legislation governing surface water pollution control; the **CWA** was formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972

DCA — Florida Department of Community Affairs

Detention — collection and temporary storage of stormwater in such a manner as to provide for treatment through physical, chemical, or biological processes with subsequent gradual release

Detention Pond — depression in land surface designed to provide stormwater detention

Direct Discharge — discharge of contaminated water back into natural system without treatment

Dredging — removing solid matter from the bottom of a water body

ECUA — Escambia County Utilities Authority

Ecosystem — an environment in which living things and their surroundings interact in a manner that sustains them both

EPA — U.S. Environmental Protection Agency

ERC — Equivalent Residential Connection, runoff from residential unit

Erosion — the action or process of cutting into or washing away, as in the erosion of land by water flowing over it

ERP — Environmental Resource Permitting

Eutrophication — the process by which waters become enriched with plant nutrients, especially phosphorus and nitrogen

FDEP — Florida Department of Environmental Protection

First Flush — first runoff volume of surface water

Herbicides — a toxic substance that destroys or inhibits plant growth

LDC — Land Development Code, specifically for Santa Rosa County

MS4s — Municipal separate storm sewer systems

Nonpoint source — pollution for a diffuse source that is difficult to measure and is highly variable due to different rain patterns and other climatic conditions.

National Pollutant Discharge Elimination System (NPDES) — comprehensive two-phased national program for addressing the non-agricultural sources of stormwater discharges, uses a permitting mechanism designed to prevent pollutants from being washed by stormwater runoff into local water bodies.

Nutrients — substance that provides nourishment, includes usable carbohydrates, protein, lipids, vitamins, minerals and water

Pesticides — any chemical or biological agent that kills plant or animal pests, e.g., herbicides, pesticides, insecticides, fungicides, rodenticides

Resource Conservation and Recovery Act (RCRA) 42 U.S.C. s/s 6901 et seq. (1976) — program requires permits for the discharge of pollutants from any point source into waters of the United States

Retention — to prevent the discharge of, a given volume of stormwater runoff into surface waters by complete on-site storage

Retention Pond — depression in land surface designed to provide stormwater retention

Runoff — water that flows across surfaces rather than permeating land; Runoff eventually enters a water body and may pick up and carry a variety of pollutants

Section 303(d) list of the Clean Water Act (CWA) — requires states to develop a list of waters not meeting water quality standards or not supporting their designated uses.

Section 305(b) of the Clean Water Act requires that states calculate TMDLs for each of the impaired water bodies

Sediment — mineral or organic material that has settled at the bottom of a lake or pond

Sediment Load — the solid material that is transported by water

Stormwater — the flow of water that results from, and that occurs immediately following, a rainfall event

Stormwater Runoff — the water flowing over the land during and immediately after a heavy rainfall that is usually full of nutrients, soil and pollutants

Surface water — the water on the surface of the land in lakes, streams, rivers, oceans, puddles, and so forth

Stormwater Utility — a public utility, similar to a sewer, water or electric utility, the mission of which is to build, operate and maintain stormwater facilities

Swale — constructed open-channel drainage trench vegetated with grass or suitable vegetation and designed to prevent erosion by temporary detention and slowing of the flow of stormwater during a rainfall event

Total Maximum Daily Load (TMDL) — estimate of the capacity of a specific water body to assimilate pollution and still achieve designated uses

Water pollution — any human caused contamination of water that reduces its usefulness to humans and other organisms in nature

Watershed — the land area that contributes to flow of water into a receiving body of water

Wetlands — an area of land in which soil is at least partially submerged by water table long enough to create hydric conditions

APPENDIX V: References

Coast Alliance. Pointless Pollution: Preventing Polluted Runoff and Protecting America's Coast.. 40 pp. plus Appendices.

Choctawhatchee, Pea and Yellow Rivers Watershed Management Authority, February 2000. Recommended Practices Manual: A Guideline For Maintenance And Service Of Unpaved Roads.

Davis, P. and B. Hitchings.(March 2000) "Protecting Stored Water with Riparian Buffers." Public Works page 30.

Delaware Riverkeeper Network (March 2001). Stormwater Runoff, Lost Resource or Community Asset? A Guide to Preventing, Capturing and Recovering Stormwater Runoff. Delaware Riverkeeper Network, Washington Crossing, PA 18977.

Florida Department of Environmental Protection (February 2000). Impaired Water Body List http://www.dep.state.fl.us/water/tmdl/index.htm

Florida Department of Environmental Protection (February 2000). Water Resource Management. Division of Water Facilities, TMDL, Section – 303(d) http://dep.state.fl.us/water/tmdl/index.htm

Florida Department of Environmental Protection (February 2000). Water Resource Management, Division of Water Facilities, TMDLs and 303(d) List http://www.dep.state.fl.us/water/tmdl/303drule.htm

International Society of Arboriculture. ***Guidelines for Developing and Evaluating Tree Ordinances***. Download at http://www2.champaign.isa-arbor.com/tree-ord/index.htm

Makepeace, D.K., D.W. Smith, and S.J. Stanley (1995). "Urban Stormwater Quality: Summary of Contaminant Data." Critical Reviews in Environmental Science and Technology. **25(2)**:93-139.

Northwest Florida Water Management District: Homepage http://www.state.fl.us/nwfwmd/index.html

Palone, R.S. and A.H. Todd (June 1998). "Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers." 40 pp.

Pierce, L (April 1999). "Improving Water Quality Through Extended Use of Vegetative Covers." CE News. 52-57.

Report of the Citizens' Task Force on Urban Stormwater Runoff. (2000) Published by Escambia County, City of Pensacola, Escambia County Utilities Authority, 21 March 2000. (see report at http://uwf.edu/whitcntr/)

State of Florida (July 1999). Air and Water Quality. Report of the Special Grand Jury. The Pensacola News Journal http://www.pensacolanewsjournal.com/

State of Florida (November 1999). Stormwater Management Plans. Florida Statutes Section 403.0891 F.S. http://www.leg.state.fl.us/Statutes/index.cfm?mode=View%20Statutes&SubMenu=1&App_mode=Display_Statute&Search_String=&URL=CH0403/SEC0893.HTM

State of Florida (November 1999). The Florida Watershed Restoration Act. Senate Bill 2282er. http://www.leg.state.fl.us/Session/index.cfm?Mode=Bills&SubMenu=1&Tab=session&BI_Mode=ViewBillInfo&BillNum=2282&Chamber=Senate&Year=1999&Title=%2D%3EBill%2520Info%3AS%25202282%2D%3ESession%25201999

State of Florida (November 1999). Watershed Improvement Districts. Florida Statutes Section 582.331. /http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&Search_String=&URL=Ch0582/SEC331.HTM&Title=->2001->Ch0582->Section%20331/

Stormwater/Wetland Committee, Escambia County, Florida (October 1999). Integrated Stormwater/Wetland Committee Report prepared for Escambia County Board of County Commissioners.

U.S Environmental Protection Agency (February 2000). Water Quality Maps. also has a Coastal nonpoint program that exempts everything that is already covered by Phase I and II Stormwater Permit Programs. Current eBase Projects. Guidance on this program is at http://www.epa.gov/OWOW/NPS/MMGI/

*U.S. Environmental Protection Agency (1999). Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Chapter 4: Management Measures for Urban Areas. Office of Water (This chapter specifies management measures to protect coastal waters from urban sources of nonpoint pollution and presents a framework for preventing and controlling urban, nonpoint sources of pollution.) http://www.epa.gov/OWOW/NPS/MMGI/Chapter4/index.html

*U.S. Environmental Protection Agency (1999). Office of Wastewater Management. What is The National Pollution Discharge Elimination system (NPDES) Storm Water Program? Office of Water http://cfpub.epa.gov/npdes/home.cfm?program_id=6

*U.S. Environmental Protection Agency (1999). Region 4, Storm Water Team: The Storm Water Team's main responsibly is evaluating the compliance of Industrial Facilities (including construction sites) with the storm water regulations and the NPDES permitting program. http://www.epa.gov/region4/water/wpeb/stormwater/index.html

U.S. Environmental Protection Agency (July 1999). The Ecological Condition of Estuaries in the Gulf of Mexico. 620-R-98-004: 71 pp.

Wenger, S. (March 1999). ***A Review of the Scientific Literature on Riparian Buffer Width, Extent, and Vegetation. (*Executive Summary).** Published by the Institute of Ecology, University of Georgia, Athens.

Wenger, S. & Fowler, L., 2000. Protecting Stream and River Corridors: Creating Effective Local Riparian Buffer Ordinances. Published by the Carl Vinson Institute of Government, University of Georgia, Athens.

APPENDIX VI: Santa Rosa County Storm Water Regulations: the Land Development Code of Santa Rosa County Relevant to Stormwater Runoff Issues

SECTION 4.03.06

Drainage Plans - The developer shall submit drainage calculations and plans for the collection, control, and disposal of run-off from a critical duration storm, up to, and including, a one hundred (100) year, 24-hour storm event. The calculations and plans shall be in accordance with specifications as required by the CE, and shall include design and performance standards pursuant to Section 62.25.025 and Section 17-3.051, Florida Administrative Code. On-site retention and detention storage shall be provided for the increased storm water run-off from the proposed development and off-site contributing areas for all critical duration design storms up to and including the twenty-four (24) hour, one hundred (100) year frequency storm. The drainage facilities shall provide a release mechanism to limit the storm water run-off peak rate and timing from the storage facility to that which would have been expected from the development site under natural or pre-developed conditions up to and including a one hundred (100) year critical duration storm. The C.E. may decrease the allowed release rate for those developments which have documented significant downstream storm-water impacts to pre-developed storm-water runoff rate from a ten (10) year storm. The C.E. May reduce the detention storage requirement for developments that provide a direct stormwater discharge to the Gulf of Mexico, Santa Rosa Sound, Escambia Bay, East Bay, Blackwater Bay, East River, Yellow River, and Blackwater River and provide 1" retention volume and recovery. Storm events and duration shall be based on FDOT, Zone 1, rainfall intensity duration curves. The plans shall include all necessary calculations and documentation demonstrating the adequacy of the facilities to accommodate off-site and on-site storm-water runoff contributions. The CE may require that the design of drainage construction for major channels or under major roads be predicated upon a more severe storm. Drainage systems in areas with no positive drainage outlet shall be designed to more stringent criteria to include retention of the twenty-four (24) hour, one hundred (100) year frequency storm with no offsite discharge. Compliance with rules and regulations of State and Federal regulatory agencies, including, but not limited to, the Florida Department of Environmental Protection and the United States Environmental Protection Agency, is the responsibility of the developer and/or his engineer and proof of such compliance in the form of permits (when required by the above agencies) must be submitted prior to the approval of the subdivision plat.

Drainage plans shall include provisions which incorporate natural drainage features into the overall drainage pattern when such incorporation does not negatively impact sensitive natural resources. Channeling runoff directly into water bodies or functioning wetlands is prohibited. Calculations for capacity of retention or detention facilities shall indicate the capacity of the facility to retain or detain with filtration at least the first inch of runoff for the design storm event. The calculations must demonstrate that the 1" retention volume will be percolated in seventy-two (72) hours, and the entire retention volume will be recovered within three hundred sixty (360) hours.

G. Storm-water Treatment Basins

1. All treatment basins intended for public ownership shall be fenced in accordance with Santa Rosa County Fence standards with adequate access provided for County maintenance.

2. Under-drain and side drain systems shall be in conformance with FDEP criteria and shall be designed to percolate and filter the one-inch (1") retention volume in thirty-six (36) hours.

3. One-half (1/2) foot of freeboard, above the maximum calculated high-water elevation for the applicable design storm, shall be provided in all ponds.

4. Basins with bank slopes designed to be steeper than 3:1 or with impoundments greater than eight (8) feet in height, as measured from the lowest point on the downstream toe, to the design top elevation of the pond, shall be considered on an individual basis. Design criteria shall be in accordance with sound engineering practice and the approval of the CE will be required.

H. Wetland Detention: Current storm-water attenuation requirements may be permitted by wetland dispersion provided all of the following conditions are demonstrated:

1. All related documents shall be signed and sealed by a registered Florida Professional Engineer;

2. The County's one-inch retention volume shall be provided in accordance with Section 4.03.06 and 4.04.03 of the Land Development Code;

3. The wetland to be utilized for stormwater attenuation must be wholly controlled by the entity seeking approval of the proposed developments;

4. An acceptable conservation easement must be provided and recorded to ensure that future development will not encroach into areas utilized to meet the stormwater attenuation requirement;

5. The Project Engineer must provide adequate documentation and evidence including narratives, calculations, maps, details, and applicable assumption for the County Engineer's review and approval;

6. All down gradient modifications required for the attenuation criteria must be included as a part of the construction/site plan approval process; and

7. All state and federal wetland regulations must be met and evidence of required permits or exemptions must be provided prior to the issuance of a development order by the C.E.

I. Velocity of Runoff - Maximum velocity of drainage in open unpaved channels shall not exceed three (3) feet per second.

J. Open Ditches or Swales - The use of open ditches or swales may be allowed, provided the following conditions are met:

a. In Easements

(1) All ditches and/or swales shall be stabilized, grassed or paved.

(2) Bank slopes shall be six (6) to one (1) or flatter, unless permanent concrete stabilization is provided.

(3) Velocity of water shall not exceed three (3) feet per second in grassed swales or six (6) feet per second in paved ditches. Velocities greater than six (6) feet per second may be allowed with appropriate energy dissipates.

b. In Road Rights-of-Way

(1) Swales shall be kept to a minimum depth.

(2) Bank slopes shall be six (6) to one (1) or flatter with a four (4) foot shoulder at a slope of .06' to 1'.

K. Minimum Slopes - The minimum slope for ditches, roadway center lines, swales, and gutters shall be three-tenths (.3) percent.

Section 4.04.03

In order to control storm-water runoff and minimize impact on existing County drainage facilities and further to aid in the protection of the quality of ground and surface water, the conceptual and detailed site drainage plan shall include at least the following provisions:

1. The site drainage plan shall include practical means of reducing the amount of pollution generated by the project to a level compatible with current Florida Water Quality Standards found in Chapters 17-2, 17-3, 17-4, and 17-6 of the Florida Administrative Code; (i.e. Department of Environmental Protection Minimum Standards). Such standards shall be met including the retention and disposal by percolation of at least the first one inch of runoff within seventy-two (72) hours.

Systems utilizing filter systems shall provide the recovery in thirty-six (36) hours. Skimming devices shall be required. Calculations must also demonstrate that the pond can percolate the entire retention volume within three hundred and sixty (360) hours.

2. On-site retention and detention storage shall be provided for the increased storm water run-off from the proposed development and offsite contributing areas for all critical duration design storms up to and including, the twenty-four (24) hour, one hundred (100) year frequency storm. The drainage facilities shall provide a release mechanism to limit the storm water run-off peak rate and timing from the storage facility to that which would have been expected from the development site under natural or pre-developed conditions for a one hundred (100) year critical duration storm. Drainage systems in areas with no positive drainage outlet shall be designed to a more stringent criteria to include the retention of the twenty-four (24) hour, one hundred (100) year frequency storm event with no offsite discharge. Rainfall intensity-duration information for calculating runoff shall be based upon the curves prepared by the Florida Department Transportation, Zone 1 area. The C.E. may decrease the allowed release rate for those developments which have documented significant down-stream storm-water impacts to predevelopment storm-water runoff rate from a ten (10) year storm.

   The C.E. may reduce the retention storage requirement for developments that provide a direct storm-water discharge to the Gulf of Mexico, Santa Rosa Sound, Escambia Bay, East Bay, Blackwater Bay, East River, Yellow River, and Blackwater River and provide 1" retention volume and recovery.

3. The drainage facilities shall be designed to accommodate off-site and on-site storm-water runoff contributions. The storm-water management plan data shall consist of, at least: inflow hydrographs, velocities, evidence of a positive drainage outlet, flood routing calculations and storage recovery calculations based upon current site percolation tests.

4. All storm-water management plans shall be so designed, signed and sealed by a Florida registered professional engineer. The Building Department shall not issue any construction permit without the storm-water plan approval from the County Engineer's Office.

5. A Florida Department of Transportation Drainage Connection Permit (or proof of exemption) pursuant to Rules of the Department of Transportation, Chapter 14-86, "Drainage Connections" as now exists or hereafter amended, shall be obtained prior to application for a building permit and submitted to the Planning and Zoning Division.

H. Additional Consideration: The County Planning and Zoning Division may require additional information to be provided by the petitioner for site plan review in order to carry out a review process which is necessary to fulfill the purpose, intent and spirit of this Ordinance. The CE or Planning Director may require a detailed drainage plan or certified boring and soils tests prior to final action in order to avoid adverse environmental impacts, particularly in large scale development proposals.

I. All proposed commercial and multifamily developments located in unincorporated areas of Santa Rosa County south of East River, and on Garcon Point, that are expected to generate wastewater flows of at least 750 gallons per day are subject to the following:

1. A sanitary sewer collection system and transmission system meeting FDEP and local utility requirements shall be installed if sanitary sewer facilities are located within 500 feet in an abutting right-of-way or easement.

2. In areas other than Garcon Point, where sanitary sewer is not currently available de to the lack of system capacity, a Dry Collection System" shall be permitted and installed in accordance with the local utility and FDEP requirements. Permits for construction of structures can be issued for development with Dry Collection Systems provided the following:

a. An onsite disposal system permit is issued by HRS,

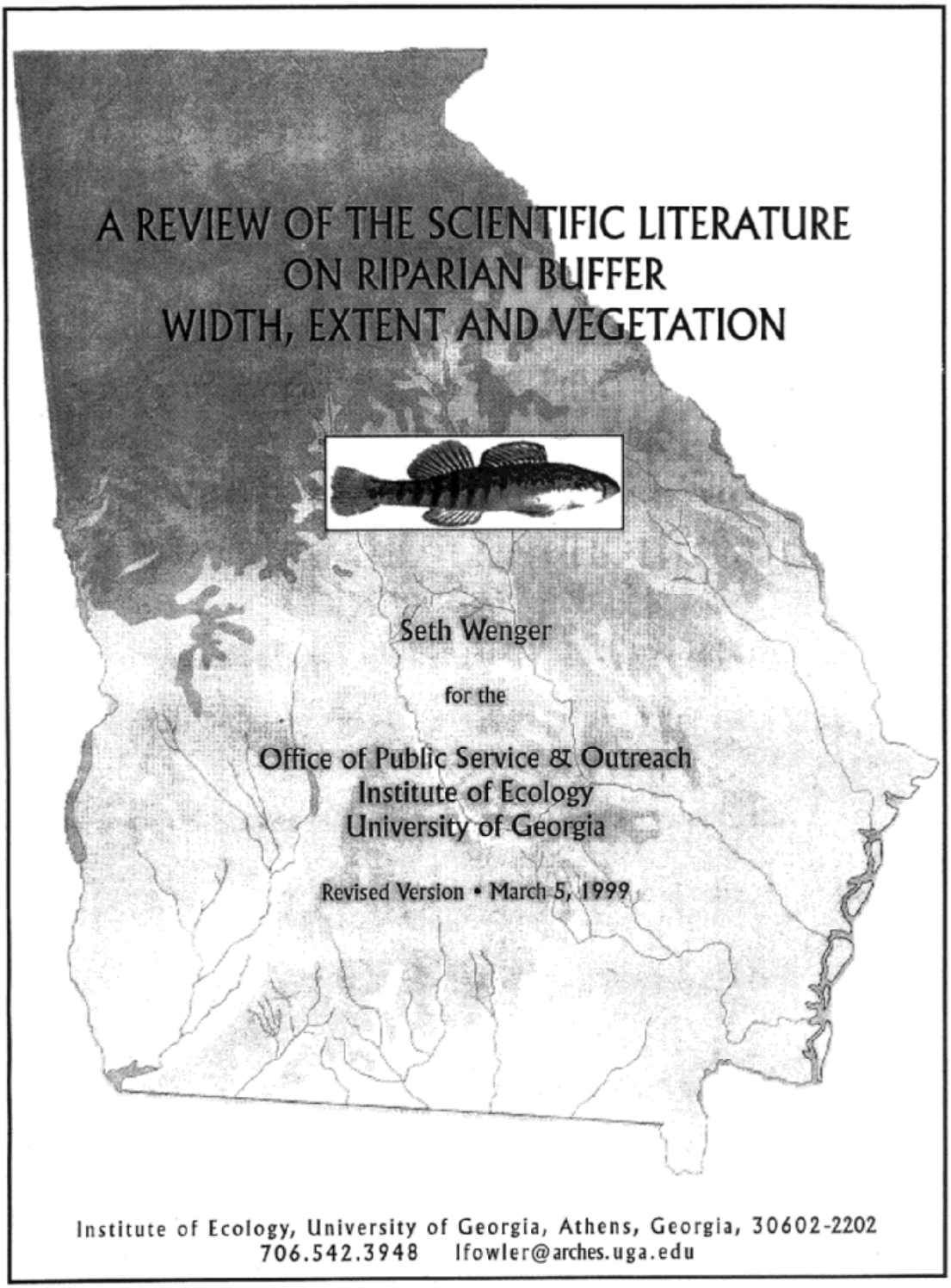
b. An agreement is executed by the developer that guarantees that the structure will be tied to the central collection system within thirty (30) days after notification by the utility that sewer is available,

c. The developer shall provide an escrow account to the county for the development in an amount to be determined by the county not less than $3,500.00 and sufficient to secure; the complete and proper removal of the onsite disposal system, physical connection of the structure to the central collection system, payment of tap fees, and restoration of all disturbed areas. The tap fee payment may be made directly to the utility and the escrow amount may be reduced by the tap fee payment.

3. If the cost of constructing the sewer system extension to the utility involves extraordinary costs such as waterway crossings, wetland crossings, extensive land clearing, etc., the developer or the utility may petition the Board of County Commissioners for an exemption from the requirement to connect the development to utility.

APPENDIX VII: Executive Summary of Scientific Literature On Riparian Buffers

Executive Summary of A Review Of The Scientific Literature On Riparian Buffer Width, Extent And Vegetation by Seth Wenger. Institute of Ecology, University of Georgia. 1999.


A REVIEW OF THE SCIENTIFIC LITERATURE
ON RIPARIAN BUFFER
WIDTH, EXTENT AND VEGETATION
Seth Wenger
for the
Office of Public Service & Outreach
Institute of Ecology
University of Georgia
Revised Version • March 5, 1999
Institute of Ecology, University of Georgia, Athens, Georgia, 30602-2202
706.542.3948 lfowler@arches.uga.edu

EXECUTIVE SUMMARY

Many local governments in Georgia are developing riparian buffer protection plans and ordinances without the benefit of scientifically-based guidelines. To address this problem, over 140 articles and books were reviewed to establish a legally-defensible basis for determining riparian buffer width, extent and vegetation. This document presents the results of this review and proposes several simple formulae for buffer delineation that can be applied on a municipal or county-wide scale.

Sediment is the worst pollutant in many streams and rivers. Scientific research has shown that vegetative buffers are effective at trapping sediment from runoff and at reducing channel erosion. Studies have yielded a range of recommendations for buffer widths; buffers as narrow as 4.6 m (15 ft) have proven fairly effective in the short term, although wider buffers provide greater sediment control, especially on steeper slopes. Long-term studies suggest the need for much wider buffers. It appears that a 30 m (100 ft) buffer is sufficiently wide to trap sediments under most circumstances, although buffers should be extended for steeper slopes. An absolute minimum width would be 9 m (30 ft). To be most effective, buffers must extend along all streams, including intermittent and ephemeral channels. Buffers must be augmented by limits on impervious surfaces and strictly enforced on-site sediment controls. Both grassed and forested buffers are effective at trapping sediment, although forested buffers provide other benefits as well.

Buffers are short-term sinks for phosphorus, but over the long term their effectiveness is limited. In many cases phosphorus is attached to sediment or organic matter, so buffers sufficiently wide to control sediment should also provide adequate short-term phosphorus control. However, long-term management of phosphorus requires effective on-site management of its sources. Buffers can provide very good control of nitrogen, include nitrate. The widths necessary for reducing nitrate concentrations vary based on local hydrology, soil factors, slope and other variables. In most cases 30 m (100 ft) buffers should provide good control, and 15 m (50 ft) buffers should be sufficient under many conditions. It is especially important to preserve wetlands, which are sites of high denitrification activity.

To maintain aquatic habitat, the literature indicates that 10-30 m (35-100 ft) native forested riparian buffers should be preserved or restored along all streams. This will provide stream temperature control and inputs of large woody debris and other organic matter necessary for aquatic organisms. While narrow buffers offer considerable habitat benefits to many species, protecting diverse terrestrial riparian wildlife communities requires some buffers of at least 100 meters (300 feet). To provide optimal habitat, native forest vegetation should be maintained or restored in all buffers.

A review of existing models for buffer width and effectiveness showed that none are appropriate for county-level buffer protection. Models were found to be either too data-intensive to be practical or else lacked verification and calibration. Potential variables for use in a buffer width formula were considered. Buffer slope and the presence of wetlands were determined to be the most important and useful factors in determining buffer width.

Three options for buffer guidelines were proposed. All are defensible given the scientific literature. The first provides the greatest level of protection for stream corridors, including good control of sediment and other contaminants, maintenance of quality aquatic habitat, and some minimal terrestrial wildlife habitat. The second option should also provide good protection under most circumstances, although severe storms, floods, or poor management of contaminant sources could more easily overwhelm the buffer.

Option One:

- Base width: 100 ft (30.5 m) plus 2 ft (0.61 m) per 1% of slope.
- Extend to edge of floodplain.
- Include adjacent wetlands. The buffer width is extended by the width of the wetlands, which guarantees that the entire wetland and an additional buffer are protected.

- Existing impervious surfaces in the riparian zone do not count toward buffer width (i.e., the width is extended by the width of the impervious surface, just as for wetlands).
- Slopes over 25% do not count toward the width.
- The buffer applies to all perennial, intermittent and ephemeral streams.

Option Two:

The same as Option One, except:

- Base width is 50 ft (15.2 m) plus 2 ft (0.61 m) per 1% of slope.
- Entire floodplain is not necessarily included in buffer, although potential sources of severe contamination should be excluded from the floodplain.
- Ephemeral streams are not included; affected streams are those that appear on US Geological Survey 1:24,000 topographic quadrangles. Alternatively, buffer can be applied to all perennial streams plus all intermittent streams of second order or larger

Option Three:

- Fixed buffer width of 100 ft.
- The buffer applies to all streams that appear on US Geological Survey 1:24,000 topographic quadrangles or, alternatively, all perennial streams plus all intermittent streams of second order or larger (as for Option Two).

For all options, buffer vegetation should consist of native forest. Restoration should be conducted when necessary and possible.

All major sources of contamination should be excluded from the buffer. These include construction resulting in major land disturbance, impervious surfaces, logging roads, mining activities, septic tank drain fields, agricultural fields, waste disposal sites, livestock, and clear cutting of forests. Application of pesticides and fertilizer should also be prohibited, except as may be needed for buffer restoration.

All of the buffer options described above will provide some habitat for many terrestrial wildlife species. To provide habitat for forest interior species, at least some riparian tracts of at least 300 ft width should also be preserved. Identification of these areas should be part of an overall, county-wide wildlife protection plan.

For riparian buffers to be most effective, some related issues must also be addressed. These include reducing impervious surfaces, managing pollutants on-site, and minimizing buffer gaps.

APPENDIX VIII: Protecting Stream and River Corridors: Creating Effective Local Riparian Buffer Ordinances

Executive Summary of Protecting Stream and River Corridors: Creating Effective Local Riparian Buffer Ordinances (Wenger and Fowler, 2000) (full model ordinance document is available within ATTACHMENT)

PP RS Public Policy Research Series

Protecting Stream and River Corridors

Creating Effective Local Riparian Buffer Ordinances

By Seth J. Wenger and Laurie Fowler

Model Ordinance Included

Carl Vinson Institute of Government
The University of Georgia

The following activities and structures are not appropriate within a riparian buffer:

- Land-disturbing activities, including construction
- Impervious surfaces
- Logging roads
- Mining
- Septic tank drain fields
- Application of pesticides and fertilizer
- Waste disposal sites
- Livestock

The 1999 study included a review of existing riparian buffer ordinances from Georgia and neighboring states. Among the local governments in Georgia that have passed effective buffer ordinances are Alpharetta, Douglas County, and Fulton County. These ordinances, together with selected buffer programs from a more thorough national review by other researchers in 1993, can provide guidance for other local governments in Georgia and are discussed in this paper. The study showed that a local buffer ordinance can take a number of different forms. For those local governments with zoning laws, an ordinance that creates a buffer overlay district is the best approach. The next best alternative is a stand-alone ordinance. Buffer protection could also be incorporated into a floodplain ordinance or an erosion and sedimentation control ordinance.

An effective riparian buffer ordinance will have the following characteristics:

1. It will meet the minimum standards for protection under the Georgia Planning Act and the Mountain and River Corridor Protection Act. A good buffer ordinance will not only adhere to state requirements, but will incorporate those requirements into a single set of local regulations, making it easy to administer.
2. It will provide for flexibility and variance procedures. In many cases, it is possible to slightly reduce the width of a portion of the buffer to accommodate the needs of a landowner while not significantly affecting buffer performance. This can be incorporated into an ordinance through rules for "minor exceptions" or "buffer averaging." In extreme cases, a variance that significantly reduces the buffer width will need to be issued to provide regulatory relief to property owners. The buffer ordinance should include variance criteria and procedures that are stringent but fair.
3. It will provide an exception for existing land uses. In other words, properties are only affected by the buffer ordinance when they

Executive Summary

The purpose of this paper is to support the efforts of local governments in Georgia that have made policy decisions to develop riparian buffer programs. A riparian buffer is a strip of naturally vegetated land along a stream or river which is protected to maintain healthy aquatic ecosystems and to provide a range of other environmental, economic, and social benefits. These benefits are numerous:

- Trapping and removing sediment from runoff
- Stabilizing stream banks and reducing channel erosion
- Trapping and removing nutrients and contaminants
- Storing flood waters, thereby reducing property damage
- Maintaining habitat for fish and other aquatic organisms
- Providing terrestrial habitat
- Maintaining good water quality
- Improving aesthetics, thereby increasing property values
- Offering recreational and educational opportunities

Despite their importance, several barriers stand in the way of effective buffer ordinances. For one, the riparian buffer requirements imposed by state laws do not provide a uniform and effective system of protection. For another, concerns over property rights have led many local officials to shy away from ordinances, however beneficial, due to fears of "takings" lawsuits. This paper is intended to help local governments develop effective, comprehensive riparian buffer ordinances that, properly administered, will not generate takings claims. A model ordinance is included.

In a monograph published by the Institute of Ecology of the University of Georgia (Wenger 1999), the author provides a thorough analysis of scientific buffer research that is applicable to Georgia. That review determined that the most effective buffers are at least 30 meters or 100 feet wide, composed of native forest, and are applied to all streams, including very small ones. Ideally, the width of the buffer will vary based on local conditions such as slope, width of the floodplain, presence of wetlands, and other factors. Two variable-width formulas that incorporate such factors are presented. The first specifies a minimum width of 100 feet, while the second provides for a minimum width of 50 feet. For local governments that find a variable-width formula too cumbersome to administer, recommendations are also provided for a fixed width buffer of 100 feet. Other widths are possible and reasonable, but narrower buffers provide significantly less benefits, and no buffer under 50 feet can be considered very effective.

change use—for example, when agricultural land is developed for residences.

4. It will provide exceptions for certain activities. Agriculture is traditionally outside the regulatory domain of local governments and may be exempted (although certain restrictions on pesticide and fertilizer application are appropriate). Forestry is acceptable within limits, although cutting within 50 feet of the stream should not be allowed. Structures such as boat ramps, which by their nature need to be on or near a stream, are also excepted.
5. It will include guidelines for buffer crossings, which should be minimized, and buffer restoration, which is sometimes necessary.

In administering a buffer ordinance, good communication with property owners is essential. This reduces the likelihood of opposition based on irrational fears and misunderstandings regarding the law. Proper enforcement is also a necessity, although previous experiences suggest that the enforcement burden need not be great. A simple and reliable system for determining buffer width—for those local governments with a variable-width ordinance—is also important. A model ordinance, an appendix to this paper, incorporates all of the provisions discussed here.

A buffer ordinance based on the recommendations contained in this paper and properly enforced should withstand any legal challenges based on property rights. One concern to local governments and land owners is the takings issue. Legally, a takings can occur when government regulates property to such a degree that little economic use is left to the landowner. However, a buffer ordinance will not usually preclude use of a property and will not necessarily reduce property values. In those cases where properties are severely impacted, the owner should receive a variance.

To analyze the impact of buffers on property rights, we examined the proportion of land parcels covered by buffers of various widths (50, 75, and 100 feet). The study showed that parcels of less than 1-2 acres can be significantly impacted by relatively narrow buffers. However, since parcels of this size or smaller have generally been dedicated to residential use and are unlikely to be converted to other uses, they are exempted from an ordinance. If they are not exempted, their owners would qualify for a variance. Large parcels of 70 acres or more usually lose less than 10 percent of their land area to buffers, a portion that should not significantly reduce their value (especially when the economic benefits of buffers are considered). Often,

Recommendations

Pass a riparian buffer ordinance based on the included model.

Develop a public information campaign explaining benefits and features of buffer ordinances.

Identify critical riparian areas in which existing land uses threaten water quality.

Identify wildlife areas, historic/prehistoric sites, and other areas meriting preservation.

Establish impervious surfaces limits.

Properly enforce erosion and sedimentation control statutes.

Amend existing floodplain ordinance to emphasize importance of limiting floodplain development and to prohibit certain activities harmful to water quality.

Set a 25 NTU turbidity standard.

the riparian zone is the least suitable area for development and is left wooded anyway. For example, a land cover analysis showed that in Cherokee County, a typical urbanizing county, over 89 percent of the area along streams is still forested.

Although riparian buffers can reduce the useful area of properties, they can also increase property values and provide other economic benefits. Properties near healthy, protected streams are worth more than properties located farther away or near unhealthy, aesthetically unpleasant waterways. Buffers protect water quality, which has immense economic value. By keeping sediment out of rivers, for example, buffers reduce the expenses of drinking water treatment plants. Clean streams and rivers are also valuable for recreation and tourism, and are vital factors in attracting new businesses and residents. Finally, protecting streams with buffers is a low-cost way to enhance the survival of endangered aquatic species. In short, riparian buffers are not only essential tools for environmental protection, they are also important factors in the long-term economic health of a community.

APPENDIX IX: Best Management Practices (BMPs) for Stormwater Runoff

Best management practices (BMPs) will be the cornerstone of restoration efforts for waters impaired by nonpoint sources. This is consistent with the general approach that has evolved to address nonpoint sources, which is based on BMPs designed to reduce pollutant loading from storm events. More specifically, it is consistent with the 1999 Florida Water Restoration Act, which clearly indicates that BMP development and implementation is the best way to deal with nonpoint source water quality impacts and provides a presumption of compliance with water quality standards to those who implement BMPs that the state has determined are effective in protecting water quality.

Keys to successfully minimizing these adverse impacts all begin with the use of **nonstructural, pollution prevention practices**. In particular, protection of the natural stormwater system, minimizing the creation of impervious surfaces, and minimizing the generation of pollutants will have a far greater benefit than any combination of structural practices. These nonstructural controls can be adopted by local governments and are a key element of the Florida Yards and Neighborhoods Program,

The next line of defense is the use of **structural BMPs**, such as swales, retention basins, or wet detention ponds, to reduce the pollutants and some of the hydrologic changes associated with unregulated urbanization. This alternative could include retrofitting existing stormwater infrastructure in areas developed before 1982 (when the state stormwater management rule was adopted).

With the adoption of the state stormwater rule in February 1982, Florida became the first state to require stormwater from all new development and redevelopment to be treated. The stormwater rule is technology-based, which uses **performance standards**, **rather than water quality-based**, which relies on effluent limitations. The first step was to establish a performance standard so that specific BMP design criteria could be developed. Ideally, the basic goal for stormwater systems serving new development would be to assure that the post-development peak discharge rate, volume, timing and pollutant load does not exceed pre-development levels. However, this goal usually is unattainable because our current BMPs, implemented either alone or in combination with other BMPs, cannot achieve this level of treatment and/or volume control, and because of the limitations imposed by variations in site conditions.

Generally, several structural and nonstructural BMPs are integrated into a BMP treatment train that is set forth in an erosion and sediment control plan and a comprehensive stormwater management plan that addresses both the water quantity and water quality changes associated with the project. It is important to remember that structural stormwater BMPs have many limitations, including the need for long-term operation and maintenance. Accordingly, renewed emphasis is needed on the use of nonstructural BMPs that seek to minimize the changes in hydrology and the addition of pollutants to the landscape. In particular, the principles of low impact design need to be

better promoted since these seek to reduce imperviousness and the resulting changes in stormwater hydrology. The implementation of these principles can be best achieved through better coordination and cooperation with the Department of Community Affairs and local government as part of the state's growth management program. Other nonstructural BMPs that need to be better promoted include the principles set forth in the Florida Yards and Neighborhoods program, street sweeping, and the reuse of roof runoff.

Efficacy of BMPs

While there has been extensive research as part of the BMP development process for urban stormwater and for a variety of agricultural activities, information about the treatment or removal efficiencies for specific pollutants other than biochemical oxygen demand and suspended solids is generally limited. As this type of pollutant-specific information is acquired and compiled, a more economical and efficacious application of stormwater runoff BMPs.

Practical Considerations for Implementing BMPs

Stormwater pollutant loadings from areas developed before the implementation of the state's stormwater rule and the use of BMPs to treat stormwater are a major contributor to water quality degradation. Retrofitting stormwater drainage systems to reduce their pollutant loading presents many challenges including a lack of land for BMPs, the cost of land for BMPs, and the need to use regional rather than onsite BMPs. Section 62-40.432(5), F.A.C also includes the following performance standard for older drainage systems: "The pollutant loading from older stormwater management systems shall be reduced as necessary to restore or maintain the beneficial uses of waters. The Districts shall establish pollutant load reduction goals (PLRGs) …." Stormwater PLRGs are defined in the Water Resource Implementation Rule, Chapter 62-40, F.A.C., as "... estimated numeric reductions in pollutant loadings needed to preserve or restore designated uses of receiving bodies of water and maintain water quality consistent with applicable state water quality standards." PLRGs are used to identify needed stormwater management controls in priority watersheds or sub-basins, to evaluate the success of these controls and the associated stormwater program activities, and to direct the development and implementation of stormwater master plans and water body restoration strategies

Structural and nonstructural BMPs for urban areas, including those for erosion and sediment control during construction, stormwater management, and onsite wastewater systems are set forth in the *Florida Development Manual: A Guide to Sound Land and Water Management* (DEP, 1988).

Agricultural BMPs

Most farms in Santa Rosa County are implementing some type of BMPs. Current on-farm management practices include sediment control, nutrient management, residue management,

and/or integrated pest management. It is generally recognized that successful BMP implementation will ultimately exist as a mosaic of practices collectively and synergistically working to mitigate adverse impacts to the environment.

In the last ten years, the Florida Legislature has enacted several new laws endorsing BMP development and implementation as the preferred means of addressing water quality concerns associated with agricultural production. These laws also provided the Department of Agriculture and Consumer Services (DACS) authority for BMP development for nonpoint source water quality impacts associated with agricultural production. Specifically, DACS' BMP water quality rulemaking authority exists within sections 403.067, and 373.406(9), F.S. Additionally, as authorized under the nitrate legislation from 1994 pursuant to section 576.045, F.S., DACS has existing BMP authority related to the protection of groundwater from potential impacts associated with the use of fertilizers and other soil amendment materials containing nitrogen.

Voluntary participation by agriculture producers in Florida's TMDL program largely rests with the successful development of a logical and comprehensive set of BMPs, codified within the context of a written manual. Given the inter-relationships between soil and water matrices and their effect on many types of production agriculture, technical criteria developed as part of a BMP manual must analyze these relationships.

Existing BMP manuals include:

1) Silviculture BMP Manual (1993),

2) Guide for Producing Container Grown Plants (1995),

3) Best Management Practices for Blended Fertilizer Plants in Florida*(1997),

4) BMPs for Agrichemical Handling & Farm Equipment Maintenance*(1998),

5) Best Management Practices for Cow/Calf Operations*(1999),

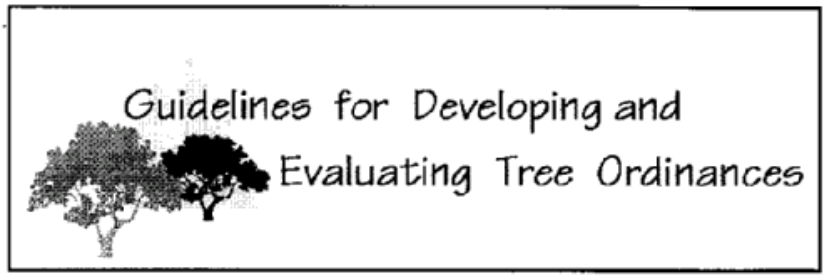
6) Water Quality/Quantity BMPs for Indian River Area Citrus Groves*(2000), and

7) Aquaculture BMPs*(2000)

*Denotes BMP manuals that have been placed on either DEP's and/or DACS Web Site.

APPENDIX X: Guidelines for Developing and Evaluating Tree Ordinances (may be downloaded in its entirety at http://www2.champaign.isa-arbor.com/tree-ord/index.htm

Next>



Guidelines for Developing and Evaluating Tree Ordinances

http://www.isa-arbor.com/tree-ord/

Site Map

Major funding for this web site is provided by the USDA Forest Service through the National Urban and Community Forestry Advisory Council and the International Society of Arboriculture.

Download Adobe Acrobat PDF version of this site (version date 10/31/01 - 1690 KB)
This document will display best using Adobe Acrobat Reader 5.0

Site search

About this site
How to use this site

Part 1. Planning for an ordinance

- **Types of ordinances**
- **Effectiveness of existing ordinances**
- **Developing a community forest management strategy**
  - **How to develop a management strategy**
    - What do you have?
      - Step A. Assess the tree resource
      - Step B. Review tree management practices
    - What do you want?
      - Step C. Identify needs
      - Step D. Establish goals
    - How do you get what you want?
      - Step E. Select tools and formulate the management strategy
      - Step F. Implement the management strategy
    - Are you getting what you want?
      - Step G. Evaluate and revise

- **Goals for community forest programs**

Part 2. Drafting an ordinance

- **Basic ordinance provisions**
- **Ordinance provisions for specific goals**
- **View or solar access ordinance provisions**

Part 3. Evaluating the urban forest and ordinance performance

Methods for evaluating tree ordinances and the urban forest ecosystem

- Sampling from populations
  - Statistical bias
  - Random sampling and random numbers
  - Stratified sampling
  - Sample size
  - Links to sample size calculators
- Photogrammetry and remote sensing techniques
  - Uses
  - Materials needed
  - Notes
  - Sampling considerations for photogrammetry
  - Estimating tree canopy cover from aerial images
    - Visual (ocular) method for estimating canopy cover
    - Dot grid method of canopy estimation
      - Determining sample size for dot grid estimates
      - Evaluation example: *Overall canopy estimates in permanent plots*
    - Line intercept or transect method
    - Digital image analysis methods
      - Comparison of image analysis and dot grids for calculating tree canopy cover
  - Other resources
- Ground survey
  - Uses
  - Materials needed
  - Notes
  - Sampling considerations for ground surveys
  - The windshield survey
    - Evaluation example: *Windshield survey for tree topping incidence*
  - The foot survey
    - Tree size
      - Evaluation example: *Measurement of canopy cover at the edge of pavement*
      - Evaluation example: *Evaluating parking lot shading*
      - Simplified guide to measuring DBH
    - Tree condition/health
    - Proximity to infrastructure and hardscape damage
    - Rating scales

- Photo points
  - Uses
  - Materials needed
  - Notes
  - Ground level photo point
  - Aerial photo points
- Record keeping and analysis
  - Uses
  - Materials needed
  - Notes
  - Geographic Information Systems (GIS)
    - Evaluation example: *Creating a forest/tree GIS*
    - Evaluation example: *CITYgreen software for ArcView GIS*
  - Tree inventory systems
    - Additional resources
    - Evaluation example: *Street tree inventory as part of a citywide GIS*
    - Evaluation example: *Street tree management*
  - Inventorying regulated private trees
- Public polling
  - Uses
  - Materials needed
  - Notes
  - Interviews
  - Self-completed questionnaires
  - Survey design considerations
  - Sampling considerations for public polling
  - Evaluation example: *Homeowner attitudes toward trees*

Special Topics:

Defining special trees: heritage, historic, and landmark trees

Definitions: Tree banks and tree banking

Concepts: Mitigating for tree loss

Literature Cited

Additional References

- General
- Dot grid estimation
- Public Polling

Next >

ISA home page | Submit comments or suggestions

APPENDIX XI: Shoreline Protection Zone Standards, as provided by Santa Rosa County Coast Coastal Construction/ Shoreline Protection

12.01.00 **COASTAL CONSTRUCTION/SHORELINE PROTECTION**: Shoreline protection zone means the area that commences at the mean high water line and runs to and includes the primary dune system. The Shoreline Protection Zone in Santa Rosa County shall also be known as the "Beach Preservation Zone."

A. The following areas along the Gulf of Mexico and Santa Rosa Sound shall be considered within Shoreline Protection Zone-1:
   1. The water-ward line shall run east/west along the line of mean high water.
   2. The landward line shall run east/west at a location coterminous with the crest of the primary dune system extending along the Gulf-fronting shoreline of the Navarre Beach Planning Area. However, in no case shall any prohibitions apply landward of the Coastal Construction Control Line nor to any structure or activity permitted under F.S. 161.053 (5).
   3. For sound-side properties the shoreline protection zone shall be the mean high tide line of Santa Rosa Sound.

B. Zone-2 is the Shoreline Protection Zone on Escambia Bay, Blackwater Bay, East Bay and the basins and bayous and shall be measured from the mean high water line to a point five (5) feet landward of the mean high water line.

C. Prohibitions - The following activities, unless specifically excepted, shall be prohibited within the shoreline protection zone:
   1. Construction of buildings and structures, except for permitted minor structures;
   2. Removal of vegetation for residential development is allowable by permit for vegetation five (5) inches and smaller in diameter.
   3. Planting of new vegetation except for native, salt-resistant species suitable for beach and dune or area stabilization.

D. Shoreline Enhancement - All persons constructing elevated boardwalks on property located in the shoreline protection zone shall include in their plans, provisions to enhance and re-vegetate the dune system on their property.

12.01.02 Design Standards in Areas Adjacent to Shoreline Protection Zone

A. All development shall be setback greater than or equal to fifty (50) feet from the landward boundary of the Shoreline Protection Zone in Zone-1 and forty-five (45) feet from the landward boundary of the Shoreline Protection Zone in Zone-2.

B. Total impervious surface, including but not limited to buildings, houses, parking lots, garages, accessory buildings, driveways, pools and walkways is limited to 75 percent of the land area of the entire site.

C. The development shall leave a minimum of 25 percent of the site as trees, shrubs, or other natural vegetation, or replace existing trees at a minimum ratio of 2:1.

D. Point source and non-point source discharges are prohibited, except for stormwater, which may be discharged only if it meets the following minimum standards:
   1. Stormwater discharges shall provide off-line retention or off-line detention with filtration of the first one inch of run-off.

E. Siltation and erosion control measures shall be applied to stabilize bands and other un-vegetated areas during and after construction. Sediment settling ponds shall be installed for stormwater runoff prior to the creation of any impervious surfaces. For lots or parcels that are cleared, silt screens shall be placed between the construction site and the water body to prevent erosion and siltation.

F. Any channels constructed shall be of a minimum depth and width capable of achieving the intended purposes. Sides of channels shall reflect an equilibrium shape to prevent slumping and erosion and to allow re-vegetation.

G. Any dredging shall be conducted at times of minimum biological activity to avoid fish migration and spawning, and other cycles and activities of wildlife.

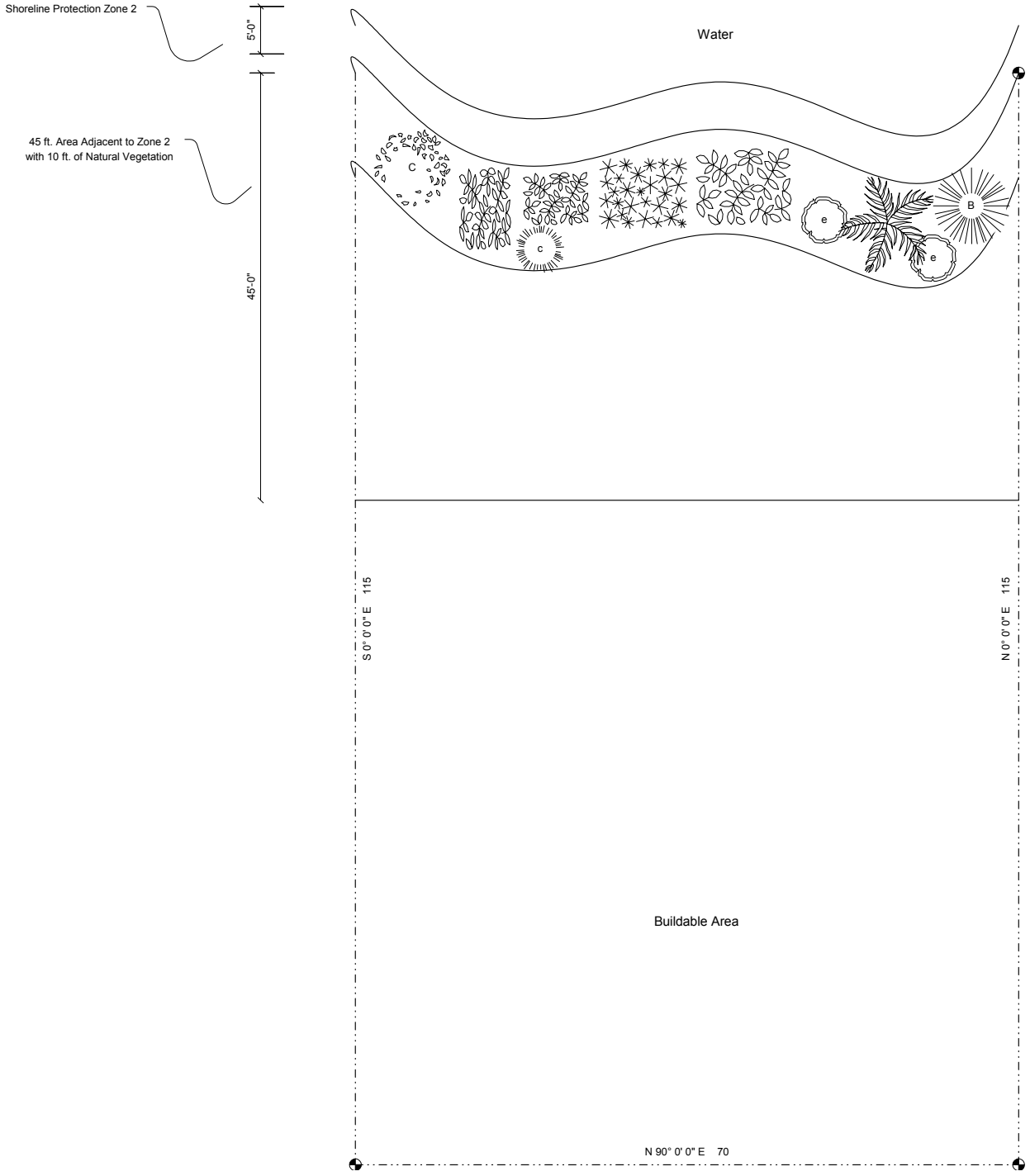
H. Any spoil that results from dredging shall be disposed of at upland sites and stabilized within thirty (30) days, unless the spoil is causing turbidity or other problems, in which case the developer must stabilize the spoil immediately.

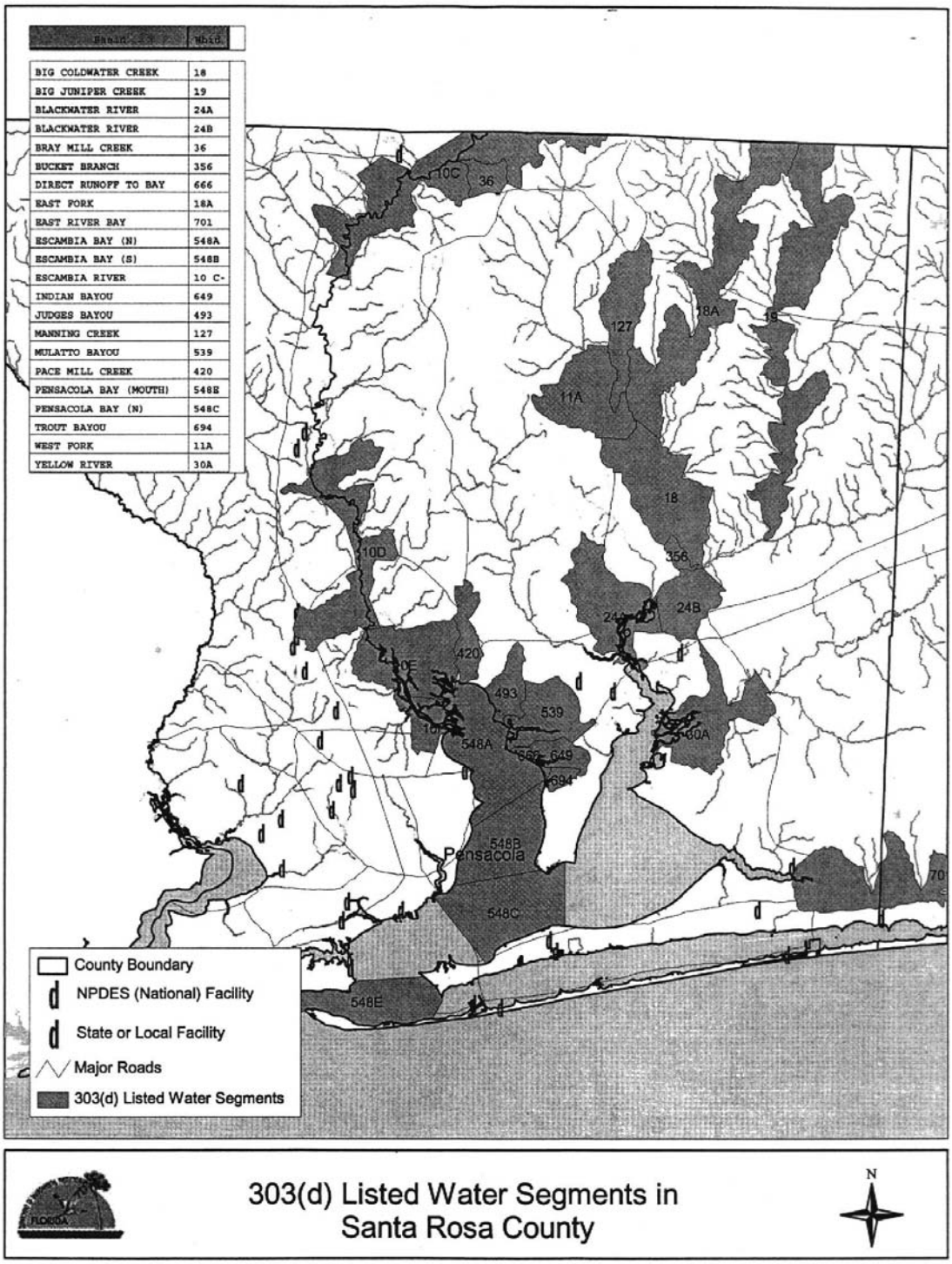
I. If dredging changes the littoral drift processes and causes adjacent shores to erode, the developer shall periodically replenish these shores with the appropriate quantity and quality of aggregate (sand).

J. If no natural vegetation exists, strips of buffer vegetation shall be planted between development activities and the Shoreline Protection Zone. Buffers shall be a minimum of ten (10) feet wide and shall be composed of native species.

K. Material used for fill shall not discolor the natural white sands of the Coastal Shoreline Protection Zone. White sand, oyster shell, limestone and white dolomite are among materials approved for fill or masonry mixes for new development or redevelopment projects in the Coastal Shoreline Protection Zone.

ZONE 2 DIAGRAM




Basin Name
Wbid.
BIG COLDWATER CREEK 18
BIG JUNIPER CREEK 19
BLACKWATER RIVER 24A
BLACKWATER RIVER 24B
BRAY MILL CREEK 36
BUCKET BRANCH 356
DIRECT RUNOFF TO BAY 666
EAST FORK 18A
EAST RIVER BAY 701
ESCAMBIA BAY (N) 548A
ESCAMBIA BAY (S) 548B
ESCAMBIA RIVER 10 C-
INDIAN BAYOU 649
JUDGES BAYOU 493
MANNING CREEK 127
MULATTO BAYOU 539
PACE MILL CREEK 420
PENSACOLA BAY (MOUTH) 548E
PENSACOLA BAY (N) 548C
TROUT BAYOU 694
WEST FORK 11A
YELLOW RIVER 30A
10C
36
18A
19
127
11A
18
10D
356
24B
420
493
539
548A
649
694
548B
Pensacola
548C
548E
70
County Boundary
NPDES (National) Facility
State or Local Facility
Major Roads
303(d) Listed Water Segments
FLORIDA
303(d) Listed Water Segments in
Santa Rosa County
N

List of Materials within ATTACHMENT

1. Delaware Riverkeeper Network (March 2001). ***Stormwater Runoff, Lost Resource or Community Asset? A Guide to Preventing, Capturing and Recovering Stormwater Runoff.*** Delaware Riverkeeper Network, Washington Crossing, PA 18977.

2. Florida Department of Environmental Regulation. ***Stormwater Management, A Guide For Floridians.*** 72 pages.

3. Choctawhatchee, Pea and Yellow Rivers Watershed Management Authority. (2000) ***Recommended Practices Manual, A Guideline For Maintenance And Service Of Unpaved Roads***. Published by the Choctawhatchee, Pea and Yellow Rivers Watershed Management Authority.

4. International Society of Arboriculture. ***Guidelines for Developing and Evaluating Tree Ordinances***. Download at http://www2.champaign.isa-arbor.com/tree-ord/index.htm

5. Wenger, S. (March 1999). ***A Review of the Scientific Literature on Riparian Buffer Width, Extent, and Vegetation. (*Executive Summary).** Published by the Institute of Ecology, University of Georgia, Athens.

6. Wenger, S. J., and L. Fowler. (2000) ***Protecting Stream and River Corridors: Creating Effective Local Riparian Buffer Ordinances.*** Published by Carl Vinson Institute of Government, The University of Georgia. 2000. 68 pages.